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[NOT FOR PUBLICATION]

MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEATS, 1945 CROP<sup>1/</sup>

by

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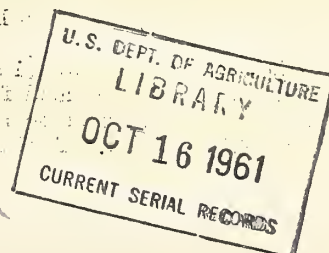
INTRODUCTION

Samples of the standard varieties and some of the new hybrid strains of hard red spring wheat, grown in cooperative experiments in the spring-wheat region<sup>2/</sup> of the United States, are milled each year by the United States Department of Agriculture and the flour baked into bread to determine their quality characteristics.

1/ Cooperative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, and the Grain Branch, Production and Marketing Administration. The samples were obtained from the cooperative experiments with the State Agricultural Experiment Stations in the spring wheat region.

2/ Clark, J. A. Results of spring wheat varieties grown in cooperative plot and nursery experiments in the spring-wheat region in 1945, with averages for 1938 to 1945. U. S. Dept. Agr., Agr. Res. Admin., Bur. Plant Indus., Soils and Agr. Engin., Div. Cereal Crops and Dis. 42 CC, 49pp. February 1946. [Processed.]

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The baking methods and techniques used on the 1945 crop were essentially the same as used in testing the wheat varieties and hybrid strains from the 1944 crop. The bread-baking tests for the 1944 and 1945 samples were made by a rich highly bromated formula. One of the regular baking methods (No. 6) used for the 1939 to 1943 crops was continued for the 1944 and 1945 experiments. A selected group of hard red spring and hard red winter wheats comparatively grown at Sheridan, Wyo., were again tested for their response to bromate. This is the fifth year such samples have been collected and tested. As in past seasons, the Minnesota and North Dakota laboratory methods were used only on the seven uniform varieties of both the Eastern and Western composites from the region.

In addition, commercial wheat samples from cars grading No. 3 or better were obtained from terminal markets by the Grain Branch, Production and Marketing Administration, for comparison with varietal samples grown in plot and nursery experiments at agricultural experiment stations.

The purpose of this report is to make available to cooperators the quality data from the 1945 crop obtained from standard varieties, new hybrid strains, and Federal supervision grade samples of hard red spring wheat, together with a summary of previous years' results.

#### SOURCE OF SAMPLES

The most extensive tests (8) were made on the Eastern and Western composite samples of each of seven uniform varieties grown in plots at cooperating stations. The bread-baking test (employing a rich highly bromated formula) was made on the variety samples from plots grown at Madison, Wis.; St. Paul, Waseca, Morris, and Crookston, Minn.; Fargo, Langdon, Mandan, Edgeley, Williston, and Dickinson, N. Dak.; Brookings and Newell, S. Dak.; Havre and Moccasin, Mont.; Sheridan and Laramie, Wyo.; and Akron, Colo. Similar tests were made on samples of new wheats grown in single increase plots (1944-1945 Arizona increases) grown at Langdon and Dickinson. Similar tests were also made on Eastern and Western composites of the 26 strains grown in Uniform Regional Nurseries, composite samples from N. Dak., and Montana Intra-State Nurseries and from Langdon and Dickinson, N. Dak., station nurseries.

There were also included 15 samples composited from sampling of carlot receipts of wheat accumulated during a 90-day period of the 1945 crop movement by the Minneapolis, Duluth, and Great Falls, office of the Grain Branch, Production and Marketing Administration. These samples represent country-run wheat of the hard red spring class and were graded under the provisions of the U. S. Grain Standards Act as No. 3 or better. These samples are hereafter referred to as commercial samples. This is the seventh season that such samples have been collected and tested.

#### METHODS USED IN THE MILLING AND BAKING TESTS

The samples were cleaned for milling by the means of a small milling separator (equipped with sieves and air blast), and a scouring machine. The wheats were tempered in two stages; first to 14 percent for 48 hours and then additional amounts of water added 1/2 hour previous to milling, raising the moisture content of the grain to between 15.0 and 16.5 percent depending upon the hardness of the variety. The hardness of the variety was determined by the means of a Strong-Scott barley pearler. The wheat was milled on an Allis-Chalmers experimental flour mill provided with three break rolls and one smooth roll. A 90 percent patent flour was made discarding the low grade.

Baking tests on all of the 1945 varietal samples were conducted by the straight-dough procedure using the commercial-bromate-malted wheat flour formula (No. 6) supplemented by potassium bromate, the amount being varied to produce an optimum or maximum loaf volume.

The No. 6 baking test (including .001 percent, or 1 milligram of bromate per 100 grams of flour) used for the 1939, 1940, 1941, 1942, and 1943 samples and is sometimes referred to as the rich dough method was continued along with the other baking tests, of the samples from the 1944 and 1945 crop.



This baking procedure is based on the method of the American Association of Cereal Chemists, with certain modifications deemed necessary for unbleached experimentally milled flour. Because of the size of the mixing bowl, ingredients sufficient for two loaves were mixed at one time. They were mixed a sufficient length of time to develop the dough properly in a Hobart-Swanson dough-mixer (108 R. P. M.) with 4 pins in the head and 2 pins in the bowl. The absorption of the flour was calculated from the amount of water added for proper consistency at the time the doughs were mixed. The absorption values are indicated in the tables. When mixed, the doughs were divided, then rounded in the hands and placed in fermentation granite-ware "oatmeal" bowls, measuring 6 inches top diameter, 3 inches bottom diameter, and 2-1/2 inches deep. The punches were made by folding the dough approximately 10 times in the hands. At the end of the fermentation period the dough was molded by a Thompson mechanical roll type "A" moulder with rolls set at a clearance of 3/8 of inch and the compression plate 1-1/8 inches. The molded doughs were placed in baking pans constructed from 2XX tin known as the tall form. The proofing time of 55 minutes, at 86° F. and baking time of 25 minutes at 450° F. were the same for all samples. Two loaves of each sample were baked but since the ingredients were mixed as for one loaf, the two are not duplicates in the sense in which that term is usually used and are not so considered herein. Data given in the tables are averages of the two loaves.

The baking method (No. 1) which had been used on all samples starting with the 1929 crop was discontinued in 1942, as it produced much lower volumes than the other baking methods used on the 1942 and the previous crops. The commercial method (No. 2) was added in 1935 and in 1936 the commercial-bromate (No. 3). For a part of the samples in 1937, the basic, commercial and commercial-bromate bakes were made. In 1938 the same bakes as reported in 1937 were made and in addition the (No. 4) malt-phosphate-bromate. In 1939, the No. 4 method, which had been found to be unsatisfactory under our conditions, was replaced by the commercial-bromate-malted wheat flour (No. 6) test. The commercial-bromate-malted wheat flour (No. 6) test was first used for part of the 1938 samples and has been continued for all of the 1939, 1940, 1941, 1942, 1943, and 1944 samples. The No. 2 and No. 3 methods were discontinued in 1944 for most tests because they gave poorer volumes than the No. 6 method.

Starting with the 1944 samples additional baking tests were made varying the amounts of bromate (0 to 4 mg. per 100 grams of flour) with the commercial bromate-malted-wheat flour (No. 6) formula. With this baking procedure the optimum or maximum loaf volume is apparently obtained with the flour from each variety or strain. It has generally been found that the loaf having the optimum volume also has the best crumb color and grain-texture of the different baking tests made. The No. 6 test appears to bring out the full strength of the wheats somewhat better than the methods perviously used. In actual practice a baking test with 1 milligram (No. 6) and 2 milligrams of bromate is made on the same day. Bakes with no bromate or increased amounts of bromate (.003 grams or higher) are made on the following days until the optimum loaf volume has been determined for each variety or strain. Average volumes are calculated from the three best bakes, only. This baking procedure brings each of the samples to its optimum volume by making provision for adequate gas production by the employment of sufficient sugar and diastatic supplements, and sufficient oxidation by the use of increasing amounts of potassium bromate. This is the baking method used in the 1945 experiments.

The only special tests made in 1945 were on the Eastern and Western composites for the seven uniform varieties by the U.S.D.A., the Minnesota and North Dakota laboratory methods, and the bromate response tests first started on spring and winter samples from Sheridan, Wyo. The latter were made from grain samples milled on the Buhler mill.

Details of the methods used in 1945, with the various ingredients are shown in Table 1.

Table 1.--Baking methods used for samples of the 1945 crop

Ingredients	Baking method	
	Commercial-bromate-malted	wheat flour
Flour (grams)	:	100.0
Yeast (grams)	:	2.0
Salt (grams)	:	1.5
Sugar (grams)	:	5.0
Potassium bromate (grams) 1/	:	.0 to .004
Malted wheat flour (grams)	:	.25
Nonfat dry milk solids (grams)	:	4.0
Shortening (grams)	:	3.0
Water absorption (percent)	:	Optimum
Mixing time (minutes)	:	Optimum for each variety
Fermentation time (minutes)	:	180

1/ 0, 1, 2, 3, and 4 mg.

Fermentation periods:

- 1st. punch after 105 minutes.
- 2nd. punch after additional 50 minutes.
- Mold after additional 25 minutes.
- Proofing time - 55 minutes.
- Baked 25 minutes at 450° F.

A check or standard flour for control purposes was included in the baking trials with each day's tests. The loaf volume for each bake with the standard flour (12.3 percent protein) and the date of the baking test are shown in the following tabulation:

Date	Volume (Cc.)	Date	Volume (Cc.)	Date	Volume (Cc.)	Date	Volume (Cc.)
Nov. 14	775	Feb. 6	752	Apr. 25	775	June 4	775
19	775	7	778	29	749	5	775
20	726	11	792	30	744	6	767
21	735	12	766	May 1	792	10	772
26	741	13	778	2	781	13	795
28	758	14	784	6	778	17	772
29	761	19	752	7	778	18	772
Dec. 3	803	Mar. 7	778	8	812	19	772
5	751	11	792	9	752	20	763
10	775	12	766	13	781	July 1	748
12	752	13	778	15	789	2	789
Jan. 2	741	Apr. 11	762	16	766	8	792
3	775	15	801	20	766	9	818
9	769	16	781	21	781	10	775
14	738	17	752	22	761	11	775
16	758	18	775	23	766	15	792
17	763	22	775	27	783	16	772
24	769	23	752	28	766	17	775
29	775	24	775	June 3	784	18	766
				Total		76	58598
				Average			771
				Standard Error			17.2

### EXPERIMENTAL RESULTS

The results for the regular methods on plot and nursery composite and station samples are given in tables 2 to 7, for the comparison of the spring and winter varieties from Sheridan, Wyo., in table 8, for U. S. D. A., North Dakota, and Minnesota methods on seven uniform varieties in table 9. The results for the commercial samples are shown in table 10, and the correlation and regression coefficients for 14 varieties and strains and the commercial samples are shown in table 11. Summaries of the comparable 1945 samples are averaged in table 12 and 8-year results in table 13. These tables are largely self-explanatory. The highest ranking variety or strain with respect to each property is indicated by underlining.

Acre yields are included, where comparable, to assist in the interpretation of results. The test weights for most of the composite and station samples were satisfactory. The milling and chemical data in table 2 are not repeated for the other baking methods reported in table 9.

All test weights were determined in the laboratory on a dockage-free basis. The protein and ash contents are reported on a 14.0 percent moisture basis and the flour yield on a moisture-free basis.



Table 2.--Yield, milling, baking, and chemical results on the uniform varieties of hard red spring wheats grown at experiment stations, from the Eastern and Western composites of the 1945 crop and averages with former years.

Section and Variety	Acre Yield Bu.	Test Weight Lbs.	Protein		Flour		Ab-sorp-tion Pct.	Mix-ing time Min.	Baking Methods and Loaf Volume				Average			
			Wheat		Flour Yield Pct.	Ash Pct.			Milligrams of Bromate			Opt-imum Cc.	Wt. of Loaf Grams	Crumb Color Score	Grain texture Score	
			Pct.	Pct.					0	1	2					3
			Pct.	Pct.												
Eastern Composite <sup>1/</sup>																
Newthatch	25.1	55.6	14.3	13.5	72.0	.44	64	2.5	801	892	908	873	908	146	83	88
Cadet	27.7	57.0	13.6	12.8	71.8	.42	65	2.0	750	848	876	860	876	148	92	93
Rival	30.5	56.0	13.3	12.2	74.2	.44	64	2.5	778	851	865	841	865	148	87	92
Regent	25.5	56.3	13.6	12.8	72.0	.44	62	2.5	758	853	848	826	853	146	83	88
Pilot	28.0	57.4	13.2	12.1	70.6	.42	62	2.5	806	842	818	822	842	148	88	88
Thatcher	24.4	56.5	13.4	12.6	71.7	.42	62	2.5	769	833	839	816	839	143	87	88
Mida	31.8	60.6	13.3	12.2	73.6	.41	62	2.0	795	824	812	810	824	151	92	90
Average																
Range																
Average	27.6	57.1	13.5	12.6	72.3	.43	63	2.4	776	849	852	835	858	147	87	90
Range	7.4	5.0	1.1	1.4	3.6	.03	3	0.5	56	68	96	63	84	8	9	5
Western Composite <sup>2/</sup>																
Thatcher	20.3	55.3	15.6	14.7	71.3	.57	66	2.5	919	1015	986	973	1015	153	78	83
Pilot	22.0	55.3	15.1	14.3	70.4	.43	64	3.0	942	1009	959	970	1009	148	85	87
Cadet	19.9	55.1	15.6	15.0	71.6	.47	68	3.0	830	965	948	960	968	151	83	83
Marquis	18.2	57.7	15.0	14.5	70.4	.45	63	2.5	830	905	959	918	959	147	88	85
Newthatch	20.5	55.2	16.2	15.6	72.3	.53	65	2.5	818	956	939	919	956	151	77	82
Ceres	20.4	58.0	15.4	14.8	71.5	.47	65	2.0	795	908	956	905	956	151	82	85
Mida	23.6	59.0	14.6	13.7	73.4	.40	65	2.5	778	903	876	852	903	151	92	90
Average																
Range																
Average	20.7	56.5	15.4	14.7	71.6	.47	65	2.6	845	952	946	928	967	150	84	85
Range	5.4	3.9	1.6	1.9	3.0	.10	4	1.0	164	112	110	121	112	6	15	8
Average Eastern and Western Composites																
Newthatch	22.8	55.4	15.3	14.6	72.2	.49	65	2.5	810	924	924	896	932	149	80	85
Thatcher	22.4	55.9	14.5	13.7	71.5	.50	64	2.5	844	924	913	895	927	148	83	86
Pilot	25.0	56.4	14.2	13.2	70.5	.43	63	2.8	874	926	886	896	926	148	87	88
Cadet	23.8	56.1	14.6	13.9	71.7	.45	67	2.5	790	907	912	910	922	150	88	88
Mida	27.7	59.8	14.0	13.0	73.5	.41	64	2.3	787	864	844	831	864	151	92	90
Average																
Range																
Average	24.3	56.7	14.5	13.7	71.9	.46	65	2.5	821	909	896	886	914	149	86	87
Range	5.3	4.4	1.3	1.6	3.0	.09	4	0.5	87	62	80	79	68	3	12	5

<sup>1/</sup> From the Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Fargo, Edgeley, Brookings, and Lincoln stations.

<sup>2/</sup> From the Dickinson, Williston, Havre, Moccasin, Sheridan, North Platte, Alliance, and Akron stations.



Table 2.--Continued

Section and Variety	Acre, Yield		Test weight Lbs.	Protein		Flour		Ab-sorp-tion Pct.	Baking Methods			Average		
	Region	Compos-ite Bu.		Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.		No. 6 Cc.	Aver. Cc.	Opt. Cc.	Weight of Loaf Grams	Crumb Color Score	Grain texture Score
Average 4 years, 1942 to 1945, inclusive														
Eastern Composite														
Newthatch	26.0	29.0	57.1	14.9	14.1	71.0	.53	65	919	886	928	149	87	88
Cadet	24.8	28.4	57.5	14.4	13.7	71.1	.52	68	893	864	916	152	92	89
Regent	24.1	27.4	57.8	14.6	13.8	71.7	.52	63	895	865	915	148	87	85
Pilot	27.2	30.7	58.3	13.7	12.6	70.5	.47	63	884	856	884	148	93	89
Rival	27.0	30.4	58.4	14.0	13.1	73.1	.53	66	880	851	884	150	94	90
Thatcher	23.3	26.0	57.6	13.8	13.0	70.0	.54	64	877	845	883	148	88	87
Average	25.4	28.7	57.8	14.2	13.4	71.2	.52	65	891	861	902	149	90	88
Range	3.9	4.7	1.3	1.2	1.5	3.1	.07	5	42	41	44	4	7	5
Western Composite														
Thatcher	27.9	23.9	57.6	15.2	14.6	69.7	.54	66	928	883	928	151	86	85
Pilot	29.3	24.5	57.3	14.8	14.1	68.8	.50	64	927	891	927	149	88	87
Ceres	26.5	23.5	59.1	15.0	14.3	69.6	.50	65	891	859	903	151	89	88
Cadet	27.7	23.3	57.1	15.2	14.7	71.5	.54	67	900	838	901	152	90	86
Marquis	23.3	20.1	58.4	14.6	14.0	68.5	.50	62	884	850	897	148	92	89
Average	26.9	23.1	57.9	15.0	14.3	69.6	.52	65	906	864	911	150	89	87
Range	6.0	4.4	2.0	.6	.7	3.0	.04	5	44	53	31	4	6	4
Average Eastern and Western Composites														
Cadet	26.3	25.9	57.3	14.8	14.2	71.3	.53	68	897	851	909	152	91	88
Pilot	28.3	27.6	57.8	14.3	13.4	69.7	.49	64	906	874	906	149	91	88
Thatcher	25.6	25.0	57.6	14.5	13.8	69.9	.54	65	903	864	906	150	87	86
Average 8 years, 1938 to 1945 inclusive														
Average Eastern and Western Composites														
Pilot	26.2	26.1	57.4	15.1	14.2	69.5	.53	64	930	898	931	149	87	88
Thatcher	24.4	24.4	57.2	15.1	14.6	69.9	.56	65	928	885	929	150	85	85

Table 3.--Yield, milling, baking, and chemical results for the leading hard red spring wheats grown in replicated "plots" in 1945.

Madison, Wis.

Variety or Cross	State or N. No.	C. I. No.	Acres yield Bu.	Test weight lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time Min.	Baking Methods and Leaf Volume					Average				
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.			Milligrams of bromate					Wt. of leaf	Crumb Color			
											0	1	2	3	4			Aver. 3 best	Leaf Score	Grain texture
Regent		12070	33.8	56.0	14.5	13.9	73.2	.41	62.0	2.5	891	931	865			896	931	147	78	88
Pilot		11945	36.0	55.1	14.7	13.5	72.0	.42	62.0	2.5	909	865	848			874	909	146	80	85
Newthatch		12318	33.3	55.5	15.5	14.6	72.3	.43	64.0	2.5	868	879	815			854	879	146	75	90
Cadet		12053	35.8	57.3	14.2	13.4	74.3	.45	67.0	2.5	873	859	821			851	873	149	88	87
Merit x Pilot	1764	12315	33.4	55.4	14.6	14.0	70.7	.50	65.0	2.5	856	856	786			833	856	146	77	88
Thatcher		10003	24.4	55.4	13.7	12.8	72.7	.44	62.0	3.0	853	824	795			824	853	146	73	88
Henry		12265	38.6	58.1	13.9	12.6	75.2	.40	62.0	2.0	839	847	833			840	847	145	72	85
Mida		12003	32.8	60.0	14.8	13.6	76.1	.43	63.0	2.0	839	815	795			816	839	149	90	85
Rival		11708	36.5	59.2	14.5	13.2	75.8	.41	65.0	2.5	821	763	726			770	821	148	83	85
H (137a-1-5-1-3)		12425	36.6	57.6	12.9	12.0	72.5	.38	62.0	3.5	761	795	720			759	795	146	88	88
Sturgeon		11703	37.0	60.0	14.7	13.5	71.3	.40	60.0	2.5	778	772	726			759	778	145	85	83
1131 x Pilot	1907	12366	34.6	60.0	15.0	13.7	71.2	.42	62.0	2.5	766	752	704			741	766	146	73	83
Pilot x Mida	1750	12316	37.2	60.9	14.4	13.4	72.9	.41	62.0	2.5	752	717	649			706	752	146	78	85
Average			34.6	57.7	14.4	13.4	73.1	.42	62.9	2.5	831	821	775			809	838	147	79	86
Range			14.2	5.8	2.6	2.6	5.7	.12	7.0	1.5	157	214	216			190	179	4	22	7

St. Paul, Minn.

Rival		11708	34.7	58.7	12.8	12.0	76.3	.62	70.0	3.0	818	806	795			806	818
Cadet		12053	36.4	56.7	12.7	11.9	72.1	.51	67.0	2.0	789	813	769			790	813
Henry		12265	40.3	58.0	12.3	11.1	75.3	.49	64.0	2.0	766	812	789			789	812
Thatcher		10003	33.7	56.5	13.1	12.2	71.8	.49	63.0	2.5	772	812	778			787	812
Newthatch		12318	34.1	56.1	13.2	12.5	74.1	.54	64.0	2.5	784	784	729			766	784
Regent		12070	29.6	56.7	12.7	11.8	72.6	.51	62.0	2.5	772	781	772			775	781
Pilot		11945	36.3	59.0	12.4	11.3	72.0	.49	66.0	2.0	752	766	763			760	766
H-44-M. x Thatcher	2761	12477	35.1	59.1	12.4	11.2	69.6	.48	64.0	2.5	726	763	681			723	763
H-44-M. x Thatcher	2762	12434	37.8	58.7	12.2	11.1	69.5	.46	65.0	2.5	744	761	698			734	761
H-44-M. x Thatcher	2760	12478	33.8	58.1	13.0	11.8	70.2	.46	64.0	2.0	729	749	729			736	749
Pilot x Mida	1756	12303	34.4	58.4	11.7	10.7	70.9	.44	63.0	3.0	696	741	620			686	741
Mida		12008	38.9	60.8	11.9	10.7	74.3	.48	65.0	2.5	704	713	629			682	713
Merit x Pilot	1764	12315	38.8	58.5	11.6	10.4	69.9	.53	71.0	2.5	677	698	623			666	698
Mercury x Thatcher	M. 2757	12426	36.6	56.5	10.7	9.5	73.4	.52	66.0	3.0	686	674	649			670	686
Pilot x Mida	1750	12316	36.0	61.5	11.5	10.3	71.5	.49	66.0	2.0	612	637	623			624	637
Average			35.8	58.2	12.3	11.2	72.2	.50	65.3	2.4	745	745				734	756
Range			10.7	5.0	2.5	3.0	6.8	.18	9.0	1.0	175	190				182	181



Table 3.--Continued

Waseca, Minn.

Variety or Cross	State or N. No.	C. I. No.	Acres Yield Bu.	Test weight Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time Min.	Baking Methods and Loaf Volume					Average	
					Wheat	Flour	Yield	Ash			Milligrams of bromate					Wt. of Loaf	Grain Color Score
											Pct.	Pct.	Pct.	Pct.	0		
Regent		12070	18.6	54.3	12.8	12.1	72.6	.58	62.0	2.5	852	818	875	862		150	77
Newthatch		12318	17.4	52.2	13.4	12.5	72.2	.57	64.0	2.5	810	786	836	807		152	78
Pilot		11945	15.7	55.9	11.4	10.4	72.1	.45	63.0	2.5	810	815	833	781		150	78
Thatcher		10003	17.8	55.9	12.6	11.8	73.4	.58	62.0	2.5	798	792	833	769		146	78
H-44-M. x Thatcher	M. 2761	12477	18.5	56.4	13.0	11.9	71.7	.56	63.0	2.5	812	830	807			149	85
Cadet		12053	18.5	54.3	12.7	11.8	70.8	.48	68.0	2.5	814	795	830	818		152	83
H-44-M. x Thatcher	M. 2762	12434	17.5	57.3	12.5	11.6	72.0	.52	64.0	2.5	755	821	795			150	85
Mida		12008	21.0	59.2	12.2	11.2	75.7	.52	61.0	2.5	780	798	798	758		152	83
Pilot x Mida	1756	12303	21.7	58.5	11.4	10.4	73.1	.50	63.0	2.5	772	775	761			151	83
Merit x Pilot	1764	12315	20.3	57.0	11.4	10.5	71.4	.50	68.0	3.5	736	769	712			155	78
Pilot x Mida	1750	12316	20.9	59.2	12.3	11.3	74.3	.57	65.0	2.5	764	763	761			151	83
Rival		11708	19.3	58.4	11.9	10.9	74.8	.55	64.0	2.0	743	763	744			150	80
Henry		12265	21.5	58.4	10.7	9.5	74.7	.43	60.0	2.5	732	755	728			150	75
Mercury x Thatcher	M. 2757	12426	19.2	55.3	11.7	10.5	73.5	.56	65.0	3.0	737	730	755	726		153	78
Average		19.1	56.6	12.1	11.2	73.0	.53	64.0	2.6		783	803				151	80
Range		4.3	7.0	2.7	3.0	4.3	.13	7.0	1.5		116	120				9	8
Morris, Minn.																	
Regent		12070	34.5	55.8	12.1	11.3	73.7	.50	60.0	3.5	792	836	827			150	93
K. W.	N. 2759	12427	38.3	58.0	12.5	11.7	76.5	.47	64.0	2.5	772	815	784			150	93
Mercury x Thatcher	N. 2757	12426	40.3	56.4	13.5	11.5	74.7	.53	65.0	2.5	812	815	735			152	87
H-44-Marquis x Thatcher	N. 2764	12477	40.1	58.0	12.4	11.5	74.8	.47	63.0	2.5	803	812	750			149	92
E-44-Marq. x Thatcher	N. 2762	12434	39.6	58.3	12.5	11.5	75.0	.44	62.0	2.5	789	809	795			148	92
Newthatch		12318	32.1	55.3	13.1	12.3	73.6	.49	62.0	2.5	755	798	730			147	95
Henry		12265	42.5	57.8	11.2	10.5	72.3	.46	62.0	3.0	772	795	750			152	93
Thatcher		10003	31.7	55.8	12.5	12.1	72.3	.44	60.0	2.5	758	784	709			146	85
Cadet		12053	36.2	57.2	12.3	11.3	73.3	.44	64.0	2.5	767	781	732			151	92
Pilot x Mida	N. 1756	12303	41.7	59.5	11.7	10.8	76.0	.41	62.0	2.5	735	752	750			149	87
Merit x Pilot	N. 1764	12315	41.5	50.7	12.3	11.4	72.5	.49	67.0	2.5	715	752	723			154	87
Pilot x Mida	N. 1750	12316	42.1	60.7	12.6	11.8	76.6	.45	64.0	2.5	674	747	692			152	86
Mida		12008	42.2	59.8	12.1	11.2	77.3	.46	63.0	2.5	739	744	744	732		152	90
Pilot	18508	11945	37.4	57.1	12.7	11.5	72.9	.43	62.0	3.0	724	738	707			148	93
Rival		11708	40.3	58.0	11.9	11.0	77.6	.51	62.0	2.5	726	732	712			150	92
Average		38.7	11.4	12.3	11.4	74.9	.46	62.8	2.6		773	768				150	89
Range		10.8	1.8	1.4	1.8	5.3	.12	7.0	0.5		104	135				8	6

Morris, Minn.

Regent		12070	34.5	55.8	12.1	11.3	73.7	.50	60.0	3.5	792	836	827			150	88
K. W.	N. 2759	12427	38.3	58.0	12.5	11.7	76.5	.47	64.0	2.5	772	815	784			150	88
Mercury x Thatcher	N. 2757	12426	40.3	56.4	12.5	11.5	74.7	.53	65.0	2.5		812	815	735		152	87
H-44-Marquis x Thatcher	N. 2761	12477	40.1	58.0	12.4	11.5	74.8	.47	63.0	2.5	803	812	750			149	87
H-44-Marq. x Thatcher	N. 2762	12434	39.6	58.3	12.5	11.5	75.0	.44	62.0	2.5	789	809	795			148	92
Newthatch		12318	32.1	55.3	13.1	12.3	73.6	.49	62.0	2.5	761	798	730			147	90
Henry		12265	42.5	57.8	11.2	10.5	72.3	.46	62.0	3.0	772	795	750			152	87
Thatcher		10603	31.7	55.8	12.5	12.1	72.3	.44	60.0	2.5	758	784	709			146	85
Cadet		12053	36.2	57.2	12.3	11.3	73.3	.44	64.0	2.5	767	781	732			151	92
Pilot x Mida	N. 1756	12303	41.7	59.5	11.7	10.8	76.0	.41	62.0	2.5	735	752	750			149	87
Merit x Pilot	N. 1764	12315	41.5	57.7	12.3	11.4	72.5	.49	67.0	2.5	730	752	723			154	87
Pilot x Mida	N. 1750	12316	42.1	60.7	12.6	11.8	73.6	.43	64.0	2.5	704	747	692			152	87
Mida		12008	42.2	59.8	12.1	11.2	77.3	.46	63.0	2.5	739	744	732			152	90
Pilot	12668	11945	37.4	57.1	12.7	11.5	73.9	.43	62.0	3.0	723	738	707			148	93
Rival		11708	40.3	58.0	11.9	11.0	77.6	.51	62.0	2.5	723	732	712			150	92
Average			38.7	11.4	12.3	11.4	74.9	.46	62.8	2.6	773	768				150	89
Range			10.8	1.8	1.4	1.8	5.3	.12	7.0	0.5	104	135				8	6



Table 3.--Continued

Crookston, Minn.

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Test weight lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time	Baking Methods and Loaf Volume										Average	
					Wheat	Flour	Yield	Ash			Milligrams of Bionate					Aver. 3 best	Opt- imum	Wt. of Loaf	Crumb Color	Grain texture	Score	
											0	1	2	3	4							Cc.
Merit x Pilot	1764	12315	36.5	54.0	14.6	13.3	69.4	.49	63	2.0	900	851	917	933	812	933	150	82	82			
Cadet		12053	29.8	55.5	14.3	13.3	70.3	.43	63	2.0	920	928	919			928	150	88	92			
Regent		12070	28.3	54.4	13.7	12.9	72.1	.47	62	2.0	886	913	903			913	147	78	87			
Newhatch		12316	27.4	53.8	15.2	14.5	72.0	.49	62	2.0	897	912	908	872		912	148	80	82			
Pilot x Mida	1750	12316	38.2	58.0	14.6	13.3	72.3	.39	60	2.0	850	889	836			858	149	87	88			
Mercury x Thatcher	2757	12426	33.4	53.0	13.9	13.1	75.0	.45	62	2.0	836	874	885		856	872	152	77	82			
Henry		12265	38.0	56.5	12.0	10.9	73.7	.40	60	1.5	815	827	845		786	829	148	72	85			
Mida		12008	35.1	58.3	13.8	12.8	74.3	.42	60	1.5	824	832	812			826	150	87	87			
Pilot x Mida	1756	12303	34.3	57.6	12.4	11.1	72.9	.39	60	1.5	792	809	783			792	150	83	83			
Average			33.4	55.7	13.8	12.8	72.4	.44	61	1.8	861	871				865	149	82	85			
Range			10.8	5.3	3.2	3.6	5.6	.10	3	.5	144	110				130	125	5	10			

Fargo, N. Dak.

Rival x Thatcher	S.D2280	12273	26.6	60.8	14.9	14.3	75.0	.37	65	3.0	934	972	911				934	149	95						92
Cadet		12053	23.6	57.6	14.3	13.6	71.9	.47	69	2.5	929	959	959				929	152	92						92
2744 x 2809	Ns. 3175	12440	28.7	61.1	15.1	14.3	73.1	.42	68	2.5	879	959	916				918	152	93						90
2809-2822 x Prem.	Ns. 3095	12359	28.3	60.9	15.1	14.6	74.4	.44	66	2.0	881	928	859				881	152	90						92
Regent		12070	24.0	59.8	15.1	14.7	71.6	.40	66	2.5	914	925	899				913	152	88						90
2744 x 2809	Ns. 3149	12480	28.9	59.7	14.6	14.0	74.7	.38	68	2.5	909	905	922				912	153	92						90
Newhatch		12318	23.1	58.5	14.9	14.8	74.1	.49	65	2.0	856	920	922				899	150	88						90
2744 x 2809	Ns. 3166	12479	29.2	60.9	14.5	13.7	73.6	.37	67	2.5	905	903	911				906	151	92						87
Renown		11947	23.9	61.0	14.0	13.4	73.5	.44	63	2.5	876	908	909				898	149	88						88
Mida		12008	27.7	61.2	13.8	13.3	73.8	.40	66	2.0	885	885	905				892	151	95						92
Pilot		11945	26.8	59.0	13.4	12.4	72.2	.41	64	2.0	886	905	870				887	150	92						95
Premier		11940	23.1	60.9	14.8	14.2	73.7	.45	70	2.5	892	899	902				898	155	93						88
Merit x Pilot	1764	12315	27.9	60.1	13.7	13.0	71.6	.41	62	2.0	885	894	878				886	153	90						93
Rival		11708	27.8	60.9	13.9	13.3	74.7	.50	67	2.0	851	892	890				878	152	93						92
Ceres x H.T.F.	1556	12263	28.1	61.1	13.9	13.2	71.2	.36	67	2.0	833	882	882				866	154	93						92
Pilot x Mida	1756	12303	26.8	61.3	13.3	12.6	74.2	.36	69	2.5	848	868	850				855	154	93						90
Thatcher		10003	26.7	60.0	13.9	13.5	71.7	.44	65	2.0	755	851	848	836			845	149	90						88
Pilot x Mida	1750	12316	25.7	61.8	13.5	12.7	73.5	.40	66	2.0	818	821	827				822	151	88						90
Marquis		3641	23.0	58.2	11.6	10.7	69.3	.46	63	2.5	769	778	772				773	150	78						87
Average			26.3	60.3	14.1	13.5	73.0	.42	66	2.3	875	893					884	152	91						90
Range			6.2	4.2	3.5	4.1	5.7	.14	8	1.0	190	194					161	194	6						8

Table 3.--Continued

Langdon, N. Dak.

Variety or Cross	State or N. No.	C. I. No.	Acres Yield Bu.	Test weight lbs.	Protein		Flour		Absorp- tion	Mix- ing time	Baking Methods and Loaf Volume						Average					
					Wheat		Yield				Ash		Milligrams of Bromate									
					Pct.	Pct.	Pct.	Pct.			Pct.	Pct.	0	1	2	3	4	Aver. 3	Opt- imum	Wt. of Loaf	Crumb Color	Grain texture
					Pct.	Pct.	Pct.	Pct.			Pct.	Pct.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Grams	Score
2744 x 2809	Ns. 3175	12440	43.0	60.9	14.9	14.0	75.5	.43	66	2.0	876	954	928	919	954	149	90	88				
Cadet		12053	36.2	58.7	14.0	13.3	72.6	.46	67	2.5	833	891	910	885	910	152	92	87				
Regent x Pilot	1753	12317	37.3	59.7	13.2	12.3	72.8	.44	65	2.5	903	909	896	903	909	148	83	85				
Regent		12070	34.8	61.2	13.7	13.2	74.8	.45	66	2.5	729	824	865	861	894	155	82	83				
Pilot		11945	34.2	58.8	13.3	12.3	73.3	.44	62	2.5	830	888	845	854	888	149	87	90				
Mida		12008	42.3	62.3	14.5	13.7	78.1	.45	67	2.5	850	885	870	868	885	156	92	87				
Newthatch		12318	32.8	59.5	14.0	13.5	74.2	.45	64	2.0	788	879	842	836	879	150	80	87				
Rival		11708	39.7	60.9	14.0	13.2	78.1	.49	65	2.0	815	862	876	866	876	152	88	90				
Merit x Pilot	1764	12315	36.7	58.0	13.3	12.6	73.0	.44	66	2.5	771	833	868	850	868	151	88	90				
Premier		11940	36.0	62.0	14.1	13.4	76.6	.44	67	2.0	809	862	827	833	862	153	93	90				
Renown		11947	32.5	62.0	13.2	12.4	74.6	.46	64	2.0	789	848	847	828	848	152	82	87				
Thatcher		10003	33.5	60.4	13.1	12.7	74.5	.42	62	2.0	775	836	821	811	836	148	83	85				
C.D.C x Mercury	Ns. 2975	12300	36.8	60.8	13.2	12.1	78.4	.44	66	2.0	761	824	807	797	824	154	83	87				
Pilot x Mida	1750	12316	39.7	63.0	13.5	11.8	75.3	.47	63	2.5	769	812	812	798	812	150	92	87				
Pilot x Mida	1756	12303	44.5	62.6	13.0	12.1	74.7	.39	63	2.0	732	795	789	772	795	149	88	83				

Edgelev, N. Dak.

Thatcher	10003	16.4	56.1	13.9	13.4	73.9	.45	60.0	2.5	854	879	850	861	879	147	83	92		
Newthatch	12318	19.0	56.6	13.9	13.4	75.7	.45	62.0	3.0	763	870	842	825	870	146	77	87		
Cadet	12053	24.6	58.6	13.7	13.2	74.2	.43	63.0	3.0		795	850	815	820	850	147	93	92	
Regent	12070	20.2	58.7	13.4	13.0	73.9	.44	62.0	3.5		804	836	758	799	836	146	80	87	
Pilot	11945	23.8	59.3	13.4	12.3	73.5	.38	60.0	2.5		778	830	789	799	830	147	88	92	
Rival	11708	29.2	60.3	13.6	12.8	77.8	.45	63.0	2.5		747	792	786	775	792	149	85	88	
Mida	12008	24.8	61.9	12.7	11.9	77.1	.40	60.0	3.0		701	752	746	733	752	148	90	88	
Average		21.1	58.8	13.5	12.9	75.2	.43	61.4	2.9		814	818		802	830	147	85	89	
Range		12.8	5.8	1.2	1.5	4.3	.07	2.0	1.0		118	133		128	107	3	13	5	



Williston, N. Dak.

Dickinson, N. Dak.

C. x H.T.F.	1556	12263	22.4	61.8	15.6	14.4	73.8	42	68	2.0	848	959	960	1010	976	1010	154	38	87
Rival	11708	24.3	61.0	14.5	13.6	75.8	47	69	2.5	919	1010	992	974	1010	151	85	90	87	87
Newthatch	12318	17.0	61.2	15.3	15.0	75.0	40	66	2.0	922	971	962	952	971	149	83	87	87	87
Regent	12070	17.9	62.0	14.9	14.4	75.0	41	66	2.0	876	906	957	939	957	151	85	88	88	88
Pilot	11945	19.1	60.2	14.0	12.8	71.7	30	66	2.0	917	937	891	915	937	150	88	90	90	90
Merit x Pilot	12362	20.4	60.7	14.9	14.1	73.3	46	69	2.0	854	934	913	900	934	153	90	90	90	90
2744 x 2809	3175	20.3	62.0	14.9	13.7	73.9	43	69	2.5	869	922	933	899	918	150	90	88	88	88
Mida x Cadet	1831	20.6	60.5	13.6	13.1	77.5	43	67	2.0	894	923	931	911	922	153	90	87	87	87
1556 x 1563	1840	23.3	61.2	14.4	13.5	74.8	37	68	2.5	909	920	908	912	920	150	90	85	85	85
Merit x Pilot	1764	16.9	60.2	14.4	13.7	73.0	47	68	2.5	868	911	914	833	898	151	85	85	85	85
Regent x Pilot	1753	22.2	62.0	13.6	12.4	72.0	39	67	2.0	871	913	945	876	913	149	83	87	87	87
Thatcher	10003	20.0	61.2	14.2	13.7	74.1	40	64	2.0	901	896		872	901	149	83	87	87	87
Regent x Mida	1843	20.3	62.7	14.5	14.0	76.2	50	66	2.0	859	897	892	883	897	151	88	90	90	90
Cadet	12430	20.2	60.5	14.0	13.2	72.4	44	68	2.0	848	894	885	876	894	155	90	92	92	92
Vesta	11712	21.7	62.6	14.1	13.4	77.4	43	66	3.0	807	892	874	858	892	150	90	90	90	90
C.D.C. x Mercury	12300	24.4	61.4	13.6	12.3	76.8	45	67	2.0	807	871	847	842	871	152	78	85	85	85
Mida x Cadet	1835	20.2	62.3	13.5	12.7	76.9	44	66	2.0	856	865	856	859	865	150	90	85	85	85
Merit x Pilot	1830	19.3	61.5	14.2	13.4	72.7	47	70	3.0	856	865	821	847	865	151	87	88	88	88
Ceres	6900	21.0	62.2	14.1	13.3	72.7	41	67	2.0	839	853	853	848	853	151	85	90	90	90
Pilot x Mida	12303	15.6	62.6	13.5	12.7	75.5	35	65	2.0	806	845	821	824	845	152	92	92	92	92
1552 x Mida	1924	27.9	62.7	13.2	12.4	75.3	45	68	2.0	778	842	833	818	842	154	80	85	85	85
R.H. x C.H.F.	1520	19.5	62.9	13.2	12.2	75.9	39	65	2.0	792	839	783	805	839	151	78	85	85	85
Marquis	3641	18.1	61.4	13.5	12.7	71.4	41	66	2.0	775	837	833	815	837	152	82	90	90	90
Mida	12008	25.0	63.0	14.3	13.3	74.8	40	67	2.0	809	833	818	820	833	155	92	88	88	88
Pilot x Mida	18318	20.5	62.7	13.8	13.0	73.9	38	66	2.0	837	807		819	827	151	82	88	88	88
Average	20.7	61.7	14.2	13.3	12.5	74.5	42	67	2.1	856	891		879	900	151	86	88	88	88
Range	10.9	2.8	2.1	2.5	6.1	1.5	6	1	1.0	159	203		171	183	6	14	7	7	7



Table 3.--Continued

Brookings, S. Dak.

Variety or Cross	State of N. No.	C. I. No.	Yield Bu.	Test Weight Lbs.	Protein		Flour Yield	Ab- sorp- tion	Mix- ing time	Baking Methods and Leaf Volume								Average	
					Wheat	Flour				Milligrams of Bromate				Aver. 3 best	Opt- imum	Wt. of Loaf	Crumb Color		
					Pct.	Pct.	0	1	2	3	4	Cc.	Cc.					Cc.	Cc.
Mida		12008	42.8	59.0	14.3	13.8	71.5	49	2.5	953	1015	939	969	1015	147	80	80		
Rival x Thatcher	SD2259	12272	42.2	57.2	14.7	14.0	74.2	49	3.0	862	968	850	893	968	150	92	90		
Newthatch		12318	26.2	51.6	15.3	14.5	69.8	48	2.0	934	945	934	938	945	147	85	87		
Pilot		11945	32.7	56.2	14.4	13.2	70.7	44	2.0	888	931	881	900	931	148	95	90		
Regent		12070	26.9	54.1	14.5	13.3	74.2	50	2.0	885	923	910	906	923	150	93	85		
Cadet		12053	30.6	55.4	14.3	13.6	69.5	50	2.5	903	914	902	906	914	150	95	90		
Thatcher		10003	24.0	54.0	13.8	13.0	70.8	43	2.5	876	903	859	879	903	144	90	88		
Merit x Pilot	NI764	12315	38.0	56.0	14.0	13.2	69.2	50	2.5	786	881	845	837	881	152	90	87		
Henry		12265	40.1	58.1	13.2	12.1	74.4	49	2.5	854	879	865	866	879	146	82	87		
Pilot x Mida	1756	12303	45.1	60.1	13.2	12.4	74.1	43	2.0	827	859	764	817	859	146	90	88		
Rival x Thatcher	SD2280	12273	37.9	57.8	13.9	13.2	74.8	44	2.5	744	845	784	791	845	148	82	87		
Rival		11708	40.3	58.0	13.7	12.9	74.9	48	2.5	836	839	792	822	839	150	92	90		
Average			35.6	56.5	14.1	13.3	72.3	47	2.4	879	900		877	909	148	89	87		
Range			21.1	5.8	2.1	2.4	5.7	07	1.0	125	231		152	176	8	15	10		

Newell, S. Dak.

R.H. x C.R.H.	1520	12050	25.5	55.5	13.6	12.5	70.2	51	815	813	761	798	818	153	85	88	
Newthatch		12318	21.8	56.3	13.7	13.3	72.7	54	818	812	750	793	818	145	90	88	
Cadet		12053	21.6	55.1	13.0	12.0	69.2	55	741	798	778	772	798	151	93	90	
Mida		12008	24.7	60.1	12.1	11.2	74.8	49	755	744	741	747	755	151	97	88	
Thatcher		10003	25.6	58.0	11.9	11.0	71.8	54	718	741	671	710	741	146	87	87	
Regent		12070	22.1	59.1	11.7	10.9	71.6	49	617	732	703	684	732	148	82	83	
Rival x Thatcher	SD2280	12273	22.8	59.7	11.9	11.2	75.5	49	669	717	707	698	717	150	83	88	
Merit x Pilot	1764	12315	27.0	58.9	11.6	10.8	75.6	58	713	715	683	704	715	154	90	87	
Pilot x Mida	1756	12303	21.2	59.4	11.2	10.3	74.9	46	698	683	671	684	698	150	93	92	
Marquis		3641	21.6	59.5	10.4	9.4	71.0	49	660	689	629	659	689	152	88	85	
Ceres		6900	23.4	58.9	10.3	9.2	70.2	47	615	623	589	609	623	152	78	78	
Pilot		11945	23.2	58.0	9.9	8.5	70.5	46	583	600	577	587	600	150	85	78	
Average			23.6	58.3	11.8	10.9	72.4	51	716	711		704	725	150	88	86	
Range			5.5	5.0	3.8	4.8	7.1	12	232	218		211	218	9	15	14	

Table 3.--Continued

Havre, Mont.

Variety or Class	State or N.No.	C. I. No.	Acres Yield Bu.	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time	Baking Methods and Loaf Volume					Average		
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.			Milligrams of Bromate					Wt. of Loaf Grams	Crumb Color	Grain texture Score
											0	1	2	3	4			
Pilot		11945	11.5	52.7	12.3	17.1	67.9	47	67	2.5	1099	1178	147	78	80			
Thatcher		10003	12.4	52.5	18.7	18.0	59.5	48	67	2.0	1151	1169	149	75	77			
Cadet		12053	11.9	52.8	18.4	17.8	57.3	48	57	2.5	965	1110	149	72	78			
Marquis		3641	12.2	56.0	18.2	17.2	58.4	48	68	2.0	1021	1096	149	78	82			
Merit x Pilot	1764	12315	10.2	55.4	18.0	17.2	58.0	52	70	2.5	934	1055	152	88	83			
Pilot x Mida	1756	12303	11.3	55.9	17.7	16.7	58.4	42	64	2.0	974	1032	150	83	83			
Ceres		6900	12.1	56.3	17.6	16.8	59.5	47	70	2.5	1021	1044	150	82	80			
Rescue	SC4188	12435	11.2	58.2	16.7	16.3	70.9	47	64	2.5	1024	1038	148	82	82			
Mida		12008	12.2	57.2	17.3	16.3	71.7	46	66	2.0	907	997	150	88	87			
Newhatch		12318	10.9	54.2	18.0	17.4	71.7	50	68	2.0	954	992	150	75	82			
Comet x 1018	1315	12060	12.7	53.7	16.5	15.6	68.6	40	67	2.5	905	948	150	83	85			
R.H. x C.R.H.	1520	12343	9.6	54.2	17.6	16.4	68.7	42	64	2.0	868	937	152	77	88			
Average			11.5	54.9	17.8	16.9	69.2	46	67	2.3	974	1049	149	80	82			
Range			3.1	5.7	2.2	2.4	4.4	12	6	.5	231	241	198	13	11			

Moccasin, Mont.

Rescue	SC4188	12435	13.5	55.9	17.2	16.9	68.3	44	62	3.0	911	1075	147	80	83		
Pilot		11945	16.1	53.5	17.6	16.6	66.1	43	65	3.0	1064	1064	146	88	90		
Cadet		12053	13.6	54.1	18.1	17.1	67.5	48	68	2.5	911	1015	153	87	87		
Pilot x Mida	NE756	12303	15.6	58.1	16.8	16.0	69.8	38	64	2.5	962	1004	149	92	90		
R.H. x C.R.H.	1520	12343	15.5	56.3	16.6	15.8	68.7	40	64	2.5	934	992	151	85	83		
Thatcher		10003	16.1	55.2	17.4	16.5	66.8	43	66	2.5	968	980	148	82	83		
Pilot x Pilot	1764	12315	16.4	54.4	16.8	16.3	67.8	54	69	3.5	879	977	154	92	90		
Newhatch		12328	16.4	54.4	17.4	16.8	71.0	46	66	2.5	886	951	148	80	87		
Ceres		6900	16.2	57.0	16.5	15.8	68.2	44	66	3.0	809	934	150	85	88		
Mida		12008	15.4	58.3	15.4	14.7	71.1	39	64	2.5	874	893	151	93	92		
Pilot x Mida	1750	12316	14.3	58.5	16.3	15.3	68.9	42	64	2.5	800	883	150	90	85		
Comet x 1018	1315	12060	16.5	55.0	15.6	14.7	67.8	38	67	2.5	859	882	151	85	88		
Comet x Pilot	1585	12073	15.3	55.7	16.3	15.5	67.7	39	66	3.5	859	879	150	75	87		
Average			15.5	55.9	16.8	16.0	68.4	43	66	2.8	917	962	150	86	87		
Range			3.0	4.8	2.7	2.4	5.0	16	7	1.0	205	207	196	18	9		



Table 3.--Continued

Sheridan, Wyo.

Variety or Class	State or N. No.	C. I. No.	Acres Yield Bu.	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time Min.	Baking Methods and Loaf Volume					Average		
					Wheat	Flour	Yield	Ash			Milligrams of Bromate					Aver. 3 best	Cc.	
											0	1	2	3	4			
																		Cc.
Ceres		6900	32.0	54.7	15.5	14.9	69.9	.55	65.0	2.0	868	939	908	905	939	150	82	88
Pilot x Mida	1769	12324	30.0	54.6	15.1	14.5	70.6	.50	62.0	2.0	800	923	908	877	922	145	83	92
Marquis		3641	31.4	54.3	15.8	15.1	67.7	.53	64.0	2.0		919	916	905	913	919	83	90
Merit x Pilot	1860	12355	33.2	54.7	14.6	13.8	71.2	.65	64.0	2.0		859	903	889	884	903	147	87
Cadet		12053	23.2	53.0	15.7	15.2	70.5	.60	66.0	2.0		865	903	881	883	903	150	83
Thatcher		10003	31.5	53.3	15.5	14.7	69.3	.55	63.0	2.0	827	903	812	847	903	146	83	90
Newthatch		12318	29.3	52.3	15.3	15.2	68.5	.58	66.0	2.0	821	901	862	861	901	147	82	88
Merit x Pilot	1764	12315	36.2	53.3	16.3	15.3	68.8	.64	66.0	2.0	809	891	868	856	891	151	83	90
Pilot x Merit	1827	12352	32.5	55.2	14.6	13.5	71.9	.53	64.0	2.0	793	879	836	838	879	148	90	90
Merit x Pilot	1652	12275	35.8	55.5	14.5	13.6	69.5	.60	68.0	2.0	722	868	842	811	868	153	90	90
Regent x Pilot	1753	12317	35.0	55.7	13.5	12.7	70.5	.56	64.0	2.0	795	854	803	817	854	148	80	88
Mida x Cadet	1752	12321	33.0	56.8	14.2	13.6	74.4	.49	64.0	2.0	721	854	842	806	854	149	82	88
Mida x Cadet	1831	12363	37.1	57.0	13.9	13.0	72.9	.48	62.0	2.0	845	845	809	833	845	146	87	90
Comet-1110 x H44	Ceres 1586	12276	35.9	56.4	13.3	12.6	73.3	.49	64.0	2.0	818	839	758	805	839	150	82	85
Merit x Pilot	1792	12362	39.6	55.3	14.7	13.9	71.3	.62	65.0	2.0	789	836	821	815	836	150	85	87
Pilot x 1315	1829	12353	36.8	53.5	14.6	13.6	70.4	.45	62.0	2.0	801	830	815	815	830	147	83	87
1441 x Renown	1833	12361	32.7	56.0	14.6	13.4	72.6	.52	62.0	2.0	763	827	763	784	827	149	87	87
Mida x Cadet	1835	12441	37.9	57.1	13.5	12.5	72.4	.47	62.0	2.0	795	813	789	799	813	145	90	93
Mida		12098	32.7	58.6	13.7	13.0	74.1	.48	66.0	2.0	753	809	738	768	809	150	87	88
Pilot x Mida	1756	12303	31.7	57.0	14.1	13.0	70.7	.46	62.0	2.0	781	801	772	785	801	149	90	88
Pilot 13		11945	37.3	57.2	12.3	11.2	71.4	.61	62.0	2.0	720	801	711	744	801	148	80	87
Comet		11465	36.7	57.0	13.5	12.6	73.4	.47	62.0	2.0	721	789	718	743	789	149	85	83
Comet x 1315	1315	12060	36.3	54.0	14.0	13.2	70.6	.46	65.0	2.0	775	786	766	776	786	154	83	87
Pilot x Mida	1750	12316	32.1	57.2	13.9	12.9	74.1	.58	66.0	2.0	761	783	710	751	783	152	85	83
Comet x Pilot	1585	12073	37.2	58.3	12.4	11.5	70.7	.45	62.0	2.0	663	643	615	640	663	151	73	78
Average		33.9	55.5	14.4	13.5	71.2	.53	63.9	2.0		842	809		814	846	149	84	88
Range		16.4	6.2	4.0	4.1	6.7	.20	6.0	0.0		296	301		273	276	9	17	15



Table 3.--Continued

Laramie, Wyo.

Variety or Class	State or N. No.	C. I. No.	Acres Yield	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time	Baking Methods and Leaf Volume					Wt. of Loaf	Average		
					Wheat	Flour	Yield	Ash			Milligrams of Bromate						Cc.	Grams	Score
					Pct.	Pct.	Pct.	Pct.			0	1	2	3	4				
Merit x Pilot 3	1764	12315	46.3	61.0	15.0	14.7	73.0	50	68	1.5	775	798	835	842	865	157	85	82	
Hope x Thatcher	II-31-2	12119	57.1	62.7	13.8	13.5	75.9	41	67	1.3	772	846	833		817	154	82	83	
Pilot		11945	50.3	61.8	14.2	13.2	75.1	45	63	1.5	806	833	818		819	151	90	93	
Cadet		12053	48.4	60.4	14.5	13.9	73.4	49	69	1.5	821	812	798		810	156	97	93	
Newthatch		12318	48.7	61.7	14.2	13.9	76.6	47	64	1.5	759	818	815		797	151	85	88	
Mida		12008	52.6	62.3	14.4	13.9	77.5	48	67	1.5	792	815	803		803	154	90	92	
Thatcher		10003	48.8	62.2	13.3	12.9	77.1	44	62	1.5	801	815	786		801	150	92	92	
Pilot x Mida	1750	12316	45.0	63.2	14.2	13.1	73.4	38	61	1.3	763	721	689		724	152	90	90	
Ceres		6900	40.1	60.8	12.2	11.7	73.8	45	70	2.0	707	730	666		701	159	78	85	
Marquis		3641	32.6	58.4	11.3	10.3	72.2	43	52	1.7	646	646	609		634	155	83	83	
Comet		11465	36.3	57.1	9.9	9.1	69.7	42	66	1.5	609	586	533		576	157	73	73	
Average		46.0		61.1	13.4	12.7	74.3	45	65	1.5	758	746			756	154	86	87	
Range		24.5		6.1	5.1	5.6	7.8	12	9	.7	260	300			259	9	24	20	
Akron, Col.																			
Converse		4141	25.6	53.5	12.6	10.9	69.4	42	57	1.7	781	856	778		806	153	88	87	
Cadet		12053	22.0	55.1	13.0	12.2	71.9	47	62	2.2	836	803	769		803	152	90	92	
Pilot		11945	21.5	53.3	13.0	11.8	70.9	45	58	2.5	836	787	723		782	151	83	88	
Thatcher		10003	16.1	54.6	13.2	12.2	70.4	47	58	2.5	784	730	738		751	144	83	87	
Merit x Pilot	1764	12315	23.7	53.7	12.1	10.9	70.8	52	62	2.5	781	722	620		708	150	83	77	
Newthatch		12318	20.5	55.0	14.3	13.4	72.9	47	62	2.0	760	778	749		762	152	82	87	
Florence		6607	20.4	55.3	11.6	10.5	71.0	40	53	1.7	758	775	692		742	156	87	87	
R. H. x C. R. H.	1520	12050	22.7	57.5	12.5	11.2	72.8	39	59	2.0	763	704	654		707	152	85	83	
Mida		12008	26.4	57.4	11.7	10.6	75.0	43	58	2.2	758	735	657		717	152	90	92	
Reward		8182	21.2	59.6	13.4	12.0	71.2	39	59	2.0	672	735	646		684	152	83	87	
Ceres		6900	20.7	56.1	12.5	11.2	72.3	45	59	2.2	735	668	629		677	151	80	82	
Pilot x Mida	1750	12316	23.2	58.5	11.1	10.6	74.2	44	60	2.0	675	594	567		612	152	82	72	
Marquis		3641	20.8	57.6	11.9	10.8	71.6	45	57	2.0	652	663	615		643	155	83	87	
Comet x Pilot	1585	12073	24.7	56.3	11.0	10.0	71.5	38	55	2.0	596	606	527		576	157	70	75	
Average		22.1		56.0	12.4	11.3	71.9	44	59	2.1	742	726	669		712	152	84	85	
Range		10.3		6.3	3.3	3.4	5.6	14	7	.8	240	265	251		230	13	20	20	

Table 4.--Yield, milling, baking, and chemical results for newer hard red spring wheats grown in single increase plots at three experiment stations in 1945.

Mandan, N. Dak.

Variety or Class	State or N. No.	C. I. No.	Acres Yield Bu.	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion time	Baking Methods and Loaf Volume					Average		
					Wheat		Ash			Milligrams of Bromate					Wt. cf Loaf	Crumb Color	Grain Texture Score
					Pct.	Pct.	Pct.	Pct.		0 1 2 3 4							
										0	1	2	3	4			
Regent x Pilot	1952	12475	51.5	61.5	14.9	13.8	72.9	38	66.0	2.5	960	983	977	973	983	149	87
Regent x 1582	1912	12446	40.5	61.3	15.9	15.0	73.6	42	64.0	2.0	856	983	974	938	983	148	83
Mida x Pilot	1792	12362	51.5	60.7	15.4	14.7	74.3	47	67.0	2.5	850	960	859	890	960	155	90
1615 x Pilot	1902		48.1	60.9	15.6	14.6	73.3	44	69.0	2.5	911	957	905	924	957	150	88
1568 x Merit	1916		46.9	61.3	15.9	15.1	76.1	36	66.0	2.5	859	956	894	903	956	151	88
Mida x Cadet	1835	12441	48.8	61.8	15.3	14.3	73.8	37	66.0	2.0	879	948	876	901	948	149	92
1615 x Pilot	1918	12447	52.4	61.6	15.3	14.4	73.3	34	66.0	2.5	928	933	853	905	933	152	90
Pilot x Merit	1984	12443	46.9	59.8	14.8	13.6	72.2	34	65.0	2.0	879	925	883	896	925	149	85
Pilot x Mida	1953	12445	55.2	63.1	15.0	14.0	73.4	33	64.0	2.0	856	911	899	889	911	149	92
Mida x 1529	1965		44.2	61.2	14.0	13.1	76.9	36	64.0	2.5	890	906	807	868	906	151	92
1441 x Renown	1833		44.2	61.7	15.7	14.8	73.4	36	67.0	2.5	901	905	804	870	905	150	93
Pilot x Merit	1898	12442	46.9	60.1	16.1	14.7	73.8	41	67.0	2.5	889	889	886	888	889	150	90
Pilot x Mida	1964		53.4	61.2	14.5	13.5	76.8	33	64.0	2.0	842	873	839	851	873	149	92
Thatcher	Check	10003	39.1	58.4	14.7	13.8	74.3	42	62.0	2.5		833	862	830	842	862	145
Pilot x Mida	1751		51.5	61.6	14.8	13.6	74.7	44	62.0	2.0	844	848	812	835	848	146	92
Marquis	Check	3641	37.7	60.8	14.2	13.7	72.6	38	64.0	2.5	747	839	830	805	839	148	80
Average			47.2	61.1	15.1	14.2	74.1	38	65.2	2.3	914	894		886	917	149	88
Range			17.5	4.7	2.1	2.0	4.7	1.4	7.0	0.5	150	165		167	144	10	13
																	7

Langdon, N. Dak.

(Arizona Increases)

Pilot x 1514	2014	12476	62.0	14.5	13.6	73.8	44.67	2.0	827	945	879			884	945	152	83	88
Mida x 1529	2013		60.8	14.5	13.6	74.4	41.64	2.0		862	876	775		838	876	150	77	88
Regent x 1315	2018		61.0	14.5	13.4	73.0	41.62	2.0	732	865	815			804	865	146	78	87
Pilot x Merit	1951		58.3	13.5	12.4	74.1	44.62	2.0	755	859	830			815	859	150	80	83
1567 x Merit	2016		59.4	13.6	12.9	73.4	50.66	2.0	717	842	813			791	842	148	78	87
1564 x Pilot	2017		60.8	13.7	12.6	74.0	40.64	2.0	781	818	766			788	818	147	88	87
Pilot x Merit	2012	12493	58.9	13.8	12.9	73.2	46.65	2.0	689	815	801			768	815	151	78	85
1614 x Cadet	2015		58.9	12.7	11.8	74.9	42.62	2.0	755	804	764			774	804	148	82	90
Pilot x Mida	1953	12445	60.5	13.2	12.0	75.3	44.64	2.0	674	781	766			740	781	150	82	85
Pilot x Mida	1769	12324	60.4	13.2	12.2	75.1	41.61	2.0	748	772	753			758	772	147	87	87
Average			60.1	13.7	12.7	74.1	43.64	2.0		836	806			796	838	149	81	87
Range			3.7	1.8	1.8	2.3	1.0	6		173	126			144	173	6	11	7



Table 4.--Continued

Dickinson, N. Dak.  
(Arizona Increases)

Variety or Cross	State or N. No.	C. I. No.	Yield Acres Bu.	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time	Baking Methods and Loaf Volume					Average				
					Wheat	Pct.	Flour	Yield			Ash	Milligrams of Bromate				Opt- imum	Wt. of Loaf	Crumb Color	Grain Texture	
												0	1	2	3					4
					Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Cc.	Cc.	Cc.	Score	Score			
1552 x Mida	2024			61.2	15.4	14.7	74.7	.42	62	1.5	845	945	939		910	149	85			
1552 x Pilot	2021			60.2	15.6	14.4	74.2	.41	64	2.0	923	922	888		911	150	82			
Pilot x Premier	2222			60.9	15.3	14.4	73.5	.34	64	2.0	871	905	879		885	150	87			
Regent x Mida	2026			61.0	15.1	14.5	75.5	.42	64	2.0	792	894	879		855	150	85			
1552 x Mida	2023			61.5	14.8	13.9	74.2	.50	62	2.0	798	891	876		855	147	88			
Mida		12008		62.8	14.6	13.7	72.5	.42	65	2.0	809	786	761		785	154	85			
1533x Pilot	2029			62.1	13.7	12.6	70.7	.43	62	2.0	769	792	750		770	148	87			
Average				61.4	14.9	14.0	73.6	.42	63	1.9	873	864			853	150	85			
Range				2.6	1.9	2.1	4.8	.16	3	.5	176	178			141	7	14			

Dickinson, N. Dak.  
(Increase Plots)

Regent x Mida	1843	12430	17.7	61.5	16.5	15.7	73.5	.47	64	2.0	980	1027	992	1000	1027	151	87	82
C. x H.T.F.	1556	12263	15.9	61.0	15.5	14.6	72.2	.43	64	2.0	965	995	942	967	995	150	88	85
Thatcher		10003	15.8	60.5	14.5	13.8	73.6	.46	65	2.0	909	977	951	946	977	150	87	88
1552 x Mida	1924	12482	24.0	62.0	14.1	13.1	73.5	.46	63	2.0	922	925	874	907	925	149	83	87
Average			18.4	61.3	15.2	14.3	73.2	.46	64	2.0	961	975		955	981	150	85	86
Range			8.2	1.5	2.4	2.6	1.4	.04	2	--	58	102		93	102	2	5	6



Table 5.--Yield, milling, baking, and chemical results on 26 wheats grown in the Uniform Regional Nursery for Eastern Composite, Western Composite, and averages of Eastern and Western Composites in 1945.

Eastern Composite

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion time Min.	Baking Methods and Loaf Volume							Wt. of Loaf Grams	Average				
					Wheat	Flour	Yield	Ash		Milligrams of Bromate				Aver. 3	Opt- imum	Crumb Color		Grain Texture				
										Pct.	Pct.	Pct.	Pct.						0	1	2	3
2822 x 2829	3172	12439	31.2	60.3	14.4	13.8	75.7	.59	68	2.5		815	879	853		849	879	151	92	92		
Rescue	4188	12435	23.0	56.3	13.5	12.7	72.1	.54	63	2.0	798	876	870		848	876	151	77	87			
Mida x Cadet	1831	12363	35.7	60.1	12.6	11.6	77.1	.51	64	2.0		824	874	833		844	874	153	83	88		
Mercury x Thatcher	II-36-67	12357	36.1	59.0	13.1	12.0	76.3	.57	67	2.5		842	871	780		831	871	151	90	87		
2809 - 2822 x Prem.	3150	12438	35.3	61.2	13.3	12.4	76.5	.54	65	2.0		775	862	865	804	844	865	153	87	90		
2809 - 2822	3129	12437	34.4	59.1	13.8	12.8	76.7	.49	64	2.0		792	851	865	784	836	865	154	93	88		
2744 x 2809	3175	12440	38.6	61.2	13.5	12.6	75.8	.56	68	2.5		812	865	824		834	865	152	90	92		
C. x H.T.F.	1556	12263	36.1	59.8	13.1	11.9	74.8	.48	66	2.0		818	862	856		845	862	153	88	90		
Regent x Mida	1843	12430	34.2	60.5	13.5	12.8	76.3	.52	64	2.0		839	859	809		836	859	150	85	90		
Merc. x H-44-Thatcher	II-38-14	12433	29.4	60.7	12.8	11.7	76.9	.53	63	2.5		812	856	812		827	856	150	87	92		
2822 x Premier	3120	12436	33.7	59.7	12.6	12.1	77.7	.52	63	2.0		821	847	803		824	847	151	90	92		
Regent x Pilot	1753	12317	27.3	59.1	13.0	11.9	70.9	.50	66	2.5		833	842	798		824	842	149	83	90		
H-44-Marg. x Thatcher	II-36-13	12309	31.7	59.6	12.7	11.7	74.5	.50	65	2.0		798	842	781		708	842	152	88	93		
Marquis	3641		23.7	58.0	13.4	12.6	73.7	.52	63	2.5		836	830	836		834	836	150	83	88		
H-44 x Marquis <sup>2</sup>	RU1527	12302	31.1	58.6	12.9	11.9	72.5	.50	66	2.0		798	836	793		811	836	156	83	92		
H-44-Marg. x Thatcher	II-36-49	12434	32.9	59.7	13.1	12.2	75.7	.51	66	2.0		784	833	833		817	833	151	88	93		
Thatcher	10003		26.1	58.3	13.3	11.5	73.7	.53	62	2.0		786	827	824		811	827	149	82	90		
Mida x Cadet	1752	12321	34.5	60.3	12.4	11.6	76.2	.56	65	2.0		803	806	824	761	811	824	152	87	93		
Merc. x H-44-Thatcher	II-38-19	12432	32.8	60.4	13.3	12.1	75.6	.55	65	2.0		769	806	744		773	806	152	85	92		
Pilot x 1315	1829	12353	34.4	58.5	12.9	11.7	75.0	.45	65	2.0		803	804	800		802	804	152	78	90		
Rel-Hope x Pilot	1907	12366	33.7	61.7	13.6	12.4	72.5	.43	66	2.0	761	801	775		779	801	152	87	92			
Merit x Pilot	1860	12355	36.8	59.4	12.7	11.9	71.9	.55	63	2.5		795	798	798		797	798	155	88	90		
Merit x Pilot	1764	12315	34.5	59.4	12.5	11.6	72.1	.54	69	2.5		770	795	775		783	795	156	83	92		
Pilot x Mida	1756	12303	36.4	62.3	12.6	11.5	75.6	.46	63	2.0	749	778	758		762	778	152	92	92			
Pilot x Mida	1869	12324	34.6	61.7	12.6	11.5	74.8	.45	64	2.0		758	772	741		757	772	152	90	92		
Pilot x Mida	1750	12316	35.4	62.6	12.9	11.9	75.8	.50	65	2.0		772	772	727		757	772	155	88	92		
Average			32.8	59.9	13.0	12.1	74.9	.52	63	2.2		805	830			813	834	152	87	91		
Range			15.6	6.3	2.1	2.3	5.6	.13	7	0.5		113	121			92	107	7	10	6		

1/ From the Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Fargo, and Brookings stations.

Table 5.--Continued

1/  
Western Composite

Variety or Cross	State or N. No.	C. I. No.	Acres Yield Bu.	Test Weight lbs.	Protein		Flour		Ab- sorp- tion time	Baking Methods and Loaf Volume					Average			
					Wheat	Flour	Yield	Ash		Milligrams of Bromate					Aver. 3 best	Opt- imum Loaf Cc.	Crumb Color Texture Score	
					Pct.	Pct.	Pct.	Pct.		0	1	2	3	4				Cc.
Regent x Pilot	1753	12317	20.8	57.1	15.5	14.8	69.6	.54	65	2.5	937	937	894		923	937	35	89
Ceres x H.T.F.	1556	12263	23.3	57.1	16.0	15.1	69.3	.42	65	2.0	899	934	906		913	934	37	86
Mida x Cadet	1752	12321	24.7	50.6	15.5	14.9	73.6	.53	66	2.0	886	928	919		911	928	35	92
Mida x Cadet	1831	12363	25.0	50.7	15.5	14.4	72.4	.42	65	2.0	898	928	882		903	928	33	86
Thatcher	10003	22.8		55.8	16.4	15.6	67.9	.47	64	2.0	910	925	865		900	925	34	82
H-44 x Marquis <sup>2</sup>	1527	12302	20.5	55.1	16.3	15.4	66.0	.50	63	2.5	847	919	862		876	919	34	85
H-24-M. x Thatcher	11-36-1312309	22.0		56.6	15.8	15.0	70.3	.50	65	2.0	916	918	903		912	918	34	90
Merit x Pilot	1764	12315	22.8	57.0	16.2	15.4	63.3	.61	70	2.5	879	917	879		892	917	34	88
Rescue	4183	12435	20.5	57.1	15.3	15.3	69.1	.47	62	2.5	883	917	853		884	917	33	90
Regent x Mida	1843	12430	22.6	50.7	16.2	15.4	72.6	.50	64	2.0	901	911	865		892	911	33	90
Merit x Pilot	1860	12355	24.1	57.0	15.6	15.1	71.4	.63	70	2.0	795	911	903		870	911	30	85
Pilot x Mida	1769	12324	23.7	50.9	15.7	14.6	69.9	.40	64	2.0	763	910	882		852	910	33	88
Merc. x Thatcher	11-36-67	12357	23.9	57.3	15.2	14.5	72.0	.51	67	2.0	871	903	865		880	903	32	89
Merc. x H-44-Thatcher	11-36-49	12434	21.1	57.3	15.5	14.6	69.1	.48	65	2.0	868	900	839		869	900	30	87
2809-2022 x Prem.	3150	12438	24.3	50.6	15.7	15.3	72.3	.49	67	2.0	815	891	886		864	891	33	90
2022 x Premier	3120	12436	24.1	57.8	15.1	14.3	73.5	.48	64	2.0	877	886	856		873	886	32	88
2744 x 2809	3175	12440	24.2	50.5	15.4	14.5	72.5	.54	69	2.5	787	882	874		843	882	31	92
Marquis	3641	19.4		57.0	16.1	15.0	68.3	.47	62	2.5	876	892	824		861	892	32	88
1131 x Pilot	1907	12366	20.8	59.0	15.8	14.8	68.5	.42	65	2.0	879	881	766		842	881	32	86
Pilot x Mida	1829	12353	20.6	55.6	16.0	15.4	69.7	.40	64	2.0	843	879	815		847	879	31	90
Pilot x Mida	1756	12303	23.6	59.6	15.7	14.6	69.3	.41	63	2.0	795	879	851		842	879	31	88
Merc. x H-44-Thatcher	11-30-44	12433	23.0	59.1	15.0	13.8	70.8	.53	63	2.0	853	873	845		857	873	35	82
2809 x 2022	3129	12437	24.1	56.3	15.5	14.6	72.0	.43	64	2.0	807	859	845		837	859	31	90
2822 x 2809	3172	12439	22.6	53.8	15.7	14.9	72.5	.53	68	2.0	809	833	842	824	833	842	30	90
Merc. x H-44-Thatcher	11-30-19	12432	23.1	50.8	15.5	14.7	71.7	.50	64	2.0	798	836	824		819	836	31	85
Pilot x Mida	1750	12316	21.4	59.7	15.5	14.3	70.0	.43	63	2.0	786	830	792		803	830	30	88
Average			22.7	57.7	15.7	14.9	70.5	.49	65	2.1	869	891			869	895	31	88
Range			5.6	4.6	1.4	1.8	7.6	.23	3	0.5	142	145			120	107	13	10

1/ From the Dickinson, Havre, Moccasin, Alliance, and Akron Stations.



Table 5.--Continued

Average of Eastern and Western Composite

Variety or Class	State or N. No.	C. I. No.	Acres Yield Bu.	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion Pct.	Baking Methods and Loaf Volume				Average	
					Wheat	Flour	Yield	Ash		No. 6	Aver- age	Opt- imum	Wt. of Loaf	Crumb Color	Grain Texture
					Pct.	Pct.	Pct.	Pct.	Pct.	Cc.	Cc.	Cc.	Grams	Score	Score
Mida x Cadet	1831	12363	30.4	59.4	14.1	13.0	74.8	.47	65	861	374	901	152	83	83
C. x H. T. F.	1556	12263	29.7	53.5	14.6	13.5	72.1	.45	66	859	379	993	152	88	88
Rescue	SO4188	12435	21.8	56.7	14.7	14.0	70.6	.51	63	890	376	997	149	77	83
Regent x Pilot	1753	12317	24.1	50.1	14.3	13.4	70.3	.52	66	885	374	890	149	84	89
Mercury x Thatcher	II-36-67	12357	30.0	58.2	14.2	13.3	74.2	.54	67	857	356	887	152	88	88
Regent x Mida	1843	12430	28.4	59.6	14.9	14.1	74.5	.51	64	870	364	885	150	84	90
H-44-Marquis x Thatcher	II-36-13	12309	26.9	58.1	14.3	13.4	72.4	.50	65	857	310	880	151	83	92
2809 - 2822 x Premier	3150	12438	30.1	59.9	14.5	13.9	74.4	.52	66	795	354	978	153	87	90
H-44 x Marquis	RI1527	12302	25.8	56.9	14.6	13.7	69.3	.50	65	823	344	878	153	80	89
Mida x Cadet	1752	12321	29.6	59.5	14.0	13.3	74.9	.55	66	845	361	876	152	86	93
Thatcher		10003	24.5	57.1	14.4	13.6	70.8	.53	63	848	356	876	149	79	86
2744 x 2809	3175	12440	31.4	59.9	14.5	13.6	74.2	.55	69	847	341	874	152	89	92
2822 x Premier	3120	12436	28.9	58.8	13.9	13.2	75.6	.50	64	849	349	867	151	86	90
Merc. x H-44-Thatcher	II-36-49	12434	27.0	58.5	14.3	13.4	72.4	.50	66	826	343	867	151	84	88
Merc. x H-44-Thatcher	II-38-14	12433	26.2	59.9	13.9	12.8	73.8	.53	63	833	342	835	151	86	90
2809 x 2822	3129	12437	29.3	57.7	14.7	13.7	74.4	.46	64	800	337	862	153	90	89
2822 x 2829	3172	12439	26.9	59.6	15.1	14.4	74.1	.56	68	812	341	861	153	91	91
Marquis		3641	21.6	57.5	14.8	13.8	71.0	.50	63	856	348	859	149	83	88
Merit x Pilot	1764	12315	28.7	58.2	14.4	13.5	70.2	.58	70	829	338	856	156	98	90
Merit x Pilot	1860	12355	30.5	58.2	13.8	13.5	71.7	.59	69	795	334	855	158	84	88
Pilot x 1315	1829	12353	27.5	57.1	14.5	13.6	72.4	.43	65	826	325	842	152	78	90
Rel.-Hope x Pilot	1907	12366	27.3	60.4	14.7	13.6	70.5	.43	66	840	311	841	152	85	89
Pilot x Mida	1869	12324	29.2	60.3	14.2	13.1	72.4	.43	64	834	305	841	152	87	90
Pilot x Mida	1756	12303	30.0	61.0	14.2	13.1	72.5	.44	63	829	302	829	150	90	92
Merc. x H-44-Thatcher	II-38-19	12432	28.0	59.6	14.4	13.4	73.7	.57	65	803	296	821	152	82	89
Pilot x Mida	1750	12316	28.4	61.2	14.2	13.1	72.9	.47	64	801	280	801	153	88	90
Average			27.8	58.8	14.4	13.5	72.7	.51	65	837	340	865	152	85	90
Range			9.8	4.5	1.3	1.6	5.6	.16	7	90	99	100	9	14	7



Table 6.--Yield, milling, baking and chemical results on hard red spring wheats grown in North Dakota and Montana Intra-State Nurseries composited from stations indicated, 1945 crop.

N. Dak. Interstate Nursery

Variety or Class	State or N. No.	C. I. No.	Yield Bu.	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion time	Min.	Baking Methods and Loaf Volume					Aver. best Cc.	Wt. of Loaf Grams	Crumb Color	Grain Texture Score
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.			Milligrams of Bromate								
											0	1	2	3	4				
2744 x 2809	3196		36.0	61.0	15.6	14.5	73.2	.43	68	2.0	894	998	942	945	998	152	90	90	
Regent x 1582	1912		31.6	60.8	15.1	14.3	73.7	.42	66	2.5	908	974	950	944	974	150	87	90	
Pilot x Merit	1898		36.1	60.7	14.8	13.9	73.6	.45	68	3.0	848	968	882	899	968	153	90	83	
Newthatch	Check		26.4	58.8	15.5	14.9	72.8	.40	64	2.5	903	966	916	928	966	148	75	85	
1615 x Pilot	1918		33.4	60.2	14.6	13.8	73.8	.42	65	2.5	877	957	911	915	957	149	92	88	
1556 x 1563	1840		36.9	59.1	14.6	13.6	72.2	.40	65	2.5	879	956	908	914	956	148	90	92	
Pilot x Merit	1984		33.6	60.0	14.4	13.4	72.6	.37	64	2.5	910	950	901	920	950	148	85	87	
Merit x Pilot	1792		37.5	60.8	14.7	13.8	72.7	.46	67	2.5	824	939	911	891	939	152	85	90	
2822 x Regent	3123		29.1	59.4	15.2	14.4	74.3	.37	65	2.5	881	931	905	906	931	149	87	87	
2744 x 2809	3200		37.6	61.1	15.5	14.5	73.7	.42	69	2.5	905	925	871	900	925	152	90	83	
Comet x 1121	1609		33.0	61.1	14.1	12.9	73.6	.39	67	2.0	842	923	842	869	923	148	88	87	
Mida x Cadet	1835		34.7	61.4	14.2	13.5	74.2	.40	65	2.0	824	922	856	867	922	152	90	92	
2822-2809 x Premier	3169		35.9	60.5	15.5	14.8	74.2	.42	65	2.0	809	917	911	879	917	152	88	92	
Pilot x Mida	1964		35.9	60.6	13.7	12.7	74.2	.36	63	2.5	877	911	865	884	911	149	87	88	
Pilot x Mida	1953		38.5	63.3	14.1	13.1	73.6	.36	64	2.5	815	905	856	859	905	150	92	90	
1552 x Mida	1924		37.3	62.1	14.0	12.9	75.2	.43	64	2.0	830	894	865	863	894	149	88	87	
Pilot x Mida	1775		32.9	62.0	14.9	14.1	73.6	.39	65	2.5	888	801	865	881	891	150	88	85	
C. K. H. x Mercury	1882		38.3	61.0	14.4	13.5	74.8	.42	65	2.5	827	889	876	864	889	149	88	90	
2822-2809 x Premier	3167		38.1	61.2	14.9	14.4	75.5	.40	67	2.0	786	889	862	846	889	154	86	86	
2744 x 2809	3190	12489	36.4	60.8	15.2	14.1	73.3	.41	65	2.0	827	888	848	854	888	148	92	87	
2744 x 2809	3174		41.2	61.6	14.7	14.0	74.2	.43	66	2.0	824	886	865	858	886	154	92	92	
2822 x Premier	3142		30.5	60.4	14.8	13.9	76.7	.40	64	2.0	809	879	874	854	879	152	90	90	
Mercury x K.H.	2010		41.1	62.2	14.6	13.4	74.6	.42	65	2.0	833	878	847	853	878	152	90	92	
Mida x 1529	1965		35.5	61.2	13.6	12.9	74.7	.38	64	2.0	827	874	868	856	874	149	85	90	
2822 x 7.29.14.6	3185		33.6	61.1	15.1	14.0	75.8	.43	67	2.0	792	873	853	839	873	154	83	83	
C.D.C. x Mercury	2852		42.6	62.3	14.3	13.3	75.7	.39	63	2.0	824	859	812	832	859	149	92	90	

Average Range

35.5	61.0	14.7	13.8	74.1	.41	65	2.3	849	917	879	882	917	150	88	89
16.2	4.2	2.0	2.0	4.5	.10	6	1.0	184	139	138	113	139	6	17	9

1/ Fargo, Langdon and Dickinson

Table 6.--Continued

Mont. Intra State Nurseries 1/

Variety or Class	State or N. No.	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Protein		Flour		Ab- sorp- tion time	Baking Methods and Loaf Volume					Average				
					Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.		Milligrams of Bromate				Aver. 3 best imm.	Opt- imum Cc.	Wt. of Loaf Cc.	Crumb Color	Grain Texture Score	
										0	1	2	3						4
Thatcher		10003	14.9	54.5	17.4	16.9	69.5	.44	66	2.0	953	980	989	1036	1002	1036	151	83	83
Pilot x Merit	1984	12443	14.0	54.5	17.2	16.3	67.6	.42	65	2.5	986	998	948		977	998	148	88	83
Pilot x Mida	1979		13.1	57.1	16.3	16.2	70.5	.45	65	2.0	956	992	963		970	992	151	92	87
Pilot x 1441-Renown	1991		14.3	54.8	17.1	15.9	66.8	.43	65	2.5	919	986	959		955	986	150	85	87
Pilot x Merit	1969	12490	15.0	56.2	16.8	15.7	70.3	.47	67	3.0	925	983	974		961	983	151	88	88
1567 x Pilot	1975		14.1	54.8	17.0	15.8	66.7	.44	65	2.5	942	975	865		934	975	150	88	83
Pilot		11945	14.0	55.3	16.6	15.5	69.9	.41	65	2.5	965	969	957		964	969	148	95	87
1449 x Pilot	2083	12491	14.6	58.0	16.1	14.8	69.5	.44	65	2.5	943	968	896		936	968	149	83	87
Pilot x Merit	1893	12442	15.2	55.4	17.0	16.0	69.9	.43	63	3.0	916	962	962	891	947	962	153	90	93
Pilot x Merit	1774		14.3	56.0	17.0	15.9	69.0	.49	69	2.5	931	962	922		933	962	153	87	88
1567 x Pilot	1955		14.0	53.6	16.6	15.5	62.4	.44	66	2.5	856	950	937		914	950	150	83	85
Pilot x Merit	1968		14.7	57.1	16.2	15.1	70.4	.43	66	2.5	939	948	922		936	948	150	88	88
Pilot x Mida	1773		15.1	57.0	16.2	15.2	70.7	.39	63	2.5	883	940	900		909	940	151	90	87
Thatcher x Ceres	1947		14.2	57.3	17.5	16.8	68.4	.42	63	2.0	871	937	913		907	937	153	75	82
Merit x Pilot	1792	12362	16.4	57.2	16.3	15.5	70.6	.51	68	2.5	876	922	936	879	912	936	153	88	92
Mida x 1529	1949		13.4	55.0	16.0	15.0	68.6	.49	68	3.0	894	931	905		910	931	153	82	87
Pilot x Merit	1993		15.0	56.2	16.2	15.2	68.7	.47	68	3.0	870	930	919		906	930	152	90	87
1449 x Pilot	2087		15.4	57.1	16.2	15.4	69.5	.50	69	2.5	871	928	897		899	933	153	92	87
1567 x Pilot	1955		14.0	58.6	16.2	15.0	68.8	.39	67	3.0	913	925	877		905	925	150	85	88
Pilot x 1315	1941		16.3	56.5	15.9	15.1	67.5	.37	67	2.5	876	919	868		883	919	153	90	90
Pilot x Mida	1953	12445	15.5	59.5	16.0	14.9	70.9	.40	66	2.5	862	908	916	903	909	916	152	93	90
Mida x 1577	2090		14.2	55.7	15.7	14.7	68.8	.41	66	2.5	866	881	845		864	881	152	87	88
Pilot x Mida	1953	12445	15.5	59.5	16.0	14.9	70.9	.40	66	2.5	862	908	916	903	909	916	152	93	90
Mida x 1577	2090		14.2	55.7	15.7	14.7	68.8	.41	66	2.5	866	881	845		864	881	152	87	88
Merit x 1315	1948		14.3	53.3	15.6	14.9	69.2	.45	67	3.0	848	874	859		860	874	154	83	87
Merit x K.H.C.	1992		14.8	56.2	16.1	15.1	69.0	.49	70	3.0	736	851	818		802	851	155	88	82
Regent x 1315	1950		17.8	55.3	14.9	14.1	70.4	.42	65	2.5	847	845	836		843	845	150	82	85
Pilot x 1315	2091		14.3	57.1	15.2	14.2	68.9	.43	68	2.5	836	841	813		830	841	153	87	87

Average  
Range915 930 151 37 37  
200 195 7 20 11

1/ Moccasin and Havre C



Table 7.--Yield, milling, baking, and chemical results on hard red spring wheats grown in the station nurseries at Langdon and Dickinson, N. Dak.

Langdon, N. Dak.

Variety or Class	State or N. No.	C. I. No.	Yield Bu.	Test Wt. Lbs.	Protein		Flour		Ab- sorp- tion	Mix- ing time	Baking Methods and Loaf Volume					Average						
					Wheat	Flour	Yield	Ash			Pct.	Pct.	Milligrams of Bromate				Aver. 3 best	Cc.	Opti- mum	Wt. of loaf	Crumb Color	Grain Texture
													0	1	2	3						
Baart 1121 x 1581	1919		30.1	61.4	14.2	13.6	76.1	.50	67.0	2.0	327	379	931	908	906	931	159	90	37			
Pilot x Mida	1735		31.1	60.2	13.9	13.3	77.0	.46	64.0	2.5	233	336	851		357	386	152	95	90			
Mida	Check		31.3	62.5	14.1	13.6	77.3	.45	67.0	2.5	309	376	862		349	376	159	97	92			
Regent x Pilot	1920		31.3	58.3	13.5	12.9	74.3	.47	62.0	3.0	362	373	862		366	373	150	88	95			
Rel. H x H44 Ceres	1706		36.7	60.5	14.4	13.6	76.4	.54	66.0	2.5	778	370	856		835	370	152	87	90			
Regent x 1139.22	2044		23.1	60.5	13.9	13.3	76.9	.47	60.0	3.0	787	362	824		324	362	150	78	33			
Mida x 1529	2013		31.9	62.0	13.7	13.2	76.2	.44	66.0	2.5	779	303	830	818	817	830	156	82	90			
1614 x Cadet	2015		23.9	60.7	12.5	11.7	74.3	.43	64.0	2.5	766	318	807		797	818	156	92	90			
Regent x 1139.22	1911		25.2	60.8	13.4	12.3	74.7	.47	62.0	2.5	795	315	795		302	315	152	35	90			
Pilot x Merit	1774		28.5	59.5	13.6	13.0	74.5	.49	64.0	2.5	723	315	733		774	315	150	37	88			
1444 x 1503	1703		34.5	60.5	13.4	12.6	76.7	.43	64.0	2.5	778	307	761		782	307	156	37	90			
Mida x 1576	1910		26.3	62.2	13.3	12.5	75.6	.43	65.0	2.0	750	755	795	749	767	795	157	90	90			
1563 x Merit	2011		35.3	61.6	13.4	12.7	77.5	.47	62.0	3.0	723	772	789	753	773	739	150	33	90			
1563 x Merit	1916		29.9	61.7	13.3	12.6	76.3	.44	66.0	2.5	715	749	786	749	761	786	159	92	92			
1441 x 1444	1843		27.1	59.6	14.4	13.6	74.7	.42	62.0	4.0	726	733	717		742	733	150	33	87			
1505 x Cadet	1909		23.9	62.2	12.3	11.5	75.1	.42	66.0	2.5	755	764	747		755	764	155	37	87			

Average	29.7	60.0	13.6	12.9	75.9	.46	64.2	2.6	739	617								307		831	154	33	89
Range	12.8	4.0	2.1	2.0	3.5	.12	7.0	2.0	161	136								164		167	9	15	5

Dickinson, N. Dak.

1552 x Mida	2032		24.3	61.4	14.6	13.8	73.3	.42	67	1.5	218	376	802					359		332	155	77	33
1552 x Mida	2034		26.3	62.5	14.1	13.1	73.2	.36	64	2.0	755	842	800					799		842	151	73	35
Pilot x Premier	2035		26.3	61.9	14.7	13.7	73.9	.36	64	2.0	337	839	798					321		339	150	28	35
1552 x Mida	2033		26.6	62.5	14.2	13.0	71.6	.37	64	2.0	761	315	204					793		315	151	75	35
Mida		12003	26.5	63.0	14.7	13.3	74.5	.35	64	2.0	792	315	718					775		315	149	90	35
H-44-1013 x 2791	1933		32.3	59.4	13.9	12.3	73.7	.37	64	2.0	752	780	671					734		780	152	75	33
H-R-R-K-E-R-H	1752		26.5	60.2	14.1	12.9	73.3	.42	64	2.0	741	766	743					750		766	150	83	37
Merc. x K-Hus.	1736		32.1	62.3	14.4	13.3	72.5	.40	67	2.0	745	761	726					744		761	155	85	38
Merc. x K.-Hus.	1999		31.6	62.0	14.5	13.4	72.3	.39	66	2.0	732	752	741					742		752	151	38	35
Average	23.2	61.7	14.4	13.3	73.2	.38	65	1.9	792	792								780		806	152	82	36
Range	8.5	3.6	.8	1.0	2.9	.07	3	.5	90	133								127		130	6	15	5

### SPRING-WINTER WHEAT COMPARISON

Samples of four hard red spring wheats and 4 hard red winter wheats were again obtained from Sheridan, Wyoming, where they were grown on similarly prepared fallow to determine if comparable high protein spring wheats would respond to increasing amounts of bromate as has been found characteristic of the winter wheats. This is the 5th season such samples have been collected and tested. The response to varying amounts of potassium bromate (0 to 4 mgs per 100 g. of flour) for the 1945 samples and a summary of the data for 5 years is shown in table 3. Samples of each of the 8 varieties were milled on the Buhler mill.

The baking results show that the bromate requirements for the 1945 winter wheats averaged twice as high as those of the spring wheats. It should be pointed out that the flour protein was nearly a percent higher in the winter wheats as compared with the spring wheats. In the 1945 winter samples three of the four varieties needed 2 mgs. of bromate with the other sample requiring 4 mgs. of bromate for optimum results. Three of the spring wheat samples, by comparison needed only 1 mg. of bromate with the other sample taking 2 mgs. of bromate. In 1944 the winter wheats required nearly twice the amount of bromate as the spring wheats, with a spread in flour protein of .6 of a percent being highest in the spring wheats. The baking results for the 1943 samples showed that the spring and winter wheats responded much alike requiring 2 and 3 mgs. of bromate while in 1942 both classes of wheat needed approximately 2 mgs. of bromate. In 1941, however, the winters required a higher percentage of bromate averaging 3 mgs. for optimum results as compared with the spring wheats which required a maximum of 2 mgs. for best results. In 1944 and 1945 some of the winters needed as much as 4 mgs. for optimum results while the spring wheats averaged much less. There was less differences in the average bromate response between the two classes of wheat in 1942 and 1943 than in either of the other 5 years. In three of the years (1942-1943-1944) the average flour protein content was highest on the spring wheats averaging 2.6 percent more for the 1942 samples. In 1941 the winter and spring wheat flours averaged the same in flour protein while in 1945 the winter wheat flour averaged higher in protein than the flour from the spring wheats. A summary of the five years results shows the hard red spring wheats to average higher in protein and loaf volume but to have slightly lower bromate requirements as compared with the winter wheats. The hard red spring varieties, for the five years tested, also averaged higher in grain and texture and were much better in crumb color as compared with the same baking properties of the hard red winter varieties. The hard red winter wheats averaged about the same in test weight per bushel, slightly higher in yield of flour but were much lower in ash content of flour than the spring wheats.



Table 3.--Yield, milling, baking, and chemical results on 4 hard red spring wheats and 4 hard red winter wheats, milled on the Buhler Mill and baked to show bromate response on the two classes of wheat, grown on comparable fallow land at Sheridan, Wyo., 1945, together with a 5-year summary.

Class and Variety	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Protein		Wheat		Absorption Pct.	Mixing time Min.	Baking Methods and Loaf Volume				Average					
				Wheat	Flour	Yield	Ash			Milligrams of Bionate				Wt. of Loaf	Crumb Color	Grain Texture			
				Pct.	Pct.	Pct.	Pct.			0	1	2	3				4	Aver. 3 Best	Optimum
Hard Red Winter																			
Minturki	6155	26.6	53.3	16.7	15.4	64.4	.43	60.0	2.0	945	992	916	931	956	992	152	65	83	
Nobred	10094	26.0	54.0	16.8	15.7	67.0	.42	63.0	2.5	905	992	912	925	943	992	149	65	85	
Karmont	6700	31.8	53.6	17.6	15.6	69.9	.46	66.0	2.0	740	962	960	983	975	983	157	72	82	
Kanred	5146	40.0	58.4	14.2	13.1	74.0	.41	60.0	2.0	758	812	772	798	794	812	152	83	87	
Average		31.1	54.8	16.3	15.0	68.8	.43	62.3	2.1	837	940	895	909	917	945	153	71	84	
Range		14.0	5.1	3.4	2.6	7.0	.05	6.0	0.5	205	180	208	185	181	180	8	18	5	
Hard Red Spring																			
Ceres	6900	32.0	54.8	15.9	15.0	71.5	.49	65.0	2.0	865	936	916		906	936	152	85	83	
Thatcher	10003	31.5	53.3	16.1	15.3	71.5	.50	65.0	2.5	928	925	839		897	928	155	75	82	
Cadet	12053	23.2	53.0	15.7	15.0	70.8	.51	64.0	2.0	871	910	865		882	910	152	85	88	
Pilot	11945	37.3	57.1	12.5	11.6	71.6	.52	62.0	2.5	761	775	755		764	775	152	80	87	
Average		31.0	54.6	15.1	14.2	71.4	.51	64.0	2.3	878	877			862	887	153	81	87	
Range		14.1	4.1	3.6	3.7	0.8	.03	3.0	0.5	161	170			142	161	3	10	8	
Summary 5 years-1941 to 1945																			
Year										Avr.								Br. Req.	
1941	25.8	55.8	17.2	16.3	58.5	.52	.66		2.0	1.5	953	1002	149	86	81				
1942	23.9	56.8	18.5	17.3	71.0	.51	.66		2.0	2.0	953	1090	148	85	76				
1943	37.2	58.7	15.6	14.8	66.4	.59	.64		2.0	2.5	828	887	150	83	79				
1944	17.3	60.6	15.9	15.0	70.6	.51	.63		1.3	1.7	901	923	150	88	93				
1945	31.0	54.6	15.1	14.2	71.4	.51	.64		2.3	1.2	862	887	153	81	87				
Average	27.0	57.3	16.5	15.5	67.6	.53	.65		1.9	1.8	899	958	150	84	83				
Four Hard Red Winter Wheats																			
1941	35.7	56.9	17.0	16.4	68.8	.42	.63		2.1	3.0	873	991	149	78	78				
1942	40.7	56.8	15.7	14.7	67.5	.52	.63		2.1	2.2	812	870	149	73	76				
1943	41.5	59.9	14.8	13.9	66.7	.52	.61		2.0	2.7	737	781	148	74	77				
1944	16.8	59.2	15.3	14.4	70.6	.45	.62		1.3	2.7	894	909	150	83	93				
1945	31.1	54.8	16.3	15.0	68.8	.43	.62		2.1	2.5	917	945	153	71	84				
Average	33.2	57.5	15.8	14.9	68.5	.47	.62		1.9	2.6	846	899	149	76	80				

# U.S.D.A., NORTH DAKOTA AND MINNESOTA METHODS

The same composite flours of seven uniform wheat varieties for the eastern and western sections were baked a sixth year by different methods including those used by the North Dakota and Minnesota laboratories. The results from the U.S.D.A. laboratory using the North Dakota and Minnesota methods and the present U.S.D.A. methods are shown in table 9.

The results from the Minnesota methods show that the 2-hour fermentation gave the best results. This is in general agreement with past years results. Cadet, appears to have greater fermentation tolerance than the other varieties as judged by the comparison of the loaf volumes for the 2 and 3 hour fermentation periods. Cadet and Regent were best in fermentation tolerance for last year's tests. The loaf volumes are again lower than either of the former or present U.S.D.A. methods and the North Dakota methods. These lower loaf volumes are due in part to the Minnesota method of sealing doughs to a uniform weight of 150 grams for all varieties, a practice not followed by the other laboratories.

The Western Composite samples baked by the Minnesota methods averaged higher than the Eastern Composite samples in loaf volume. The protein content of the Eastern Composite samples were lowest. Certain varieties, especially Regent, Pilot, and Rival from the Eastern Composite and Thatcher, Pilot, Newthatch, and Marquis from the Western Composite appears to be more severely injured than the other varieties, by the longer (3hr.) fermentation. The Western Composite varieties, as an average, showed more injury by the longer fermentation than did the Eastern Composite varieties. The varieties have been ranked in descending order of loaf volume for all the baking methods used, with the average rank and loaf volume of all 8 methods included for comparative purposes. The data show that of the two Minnesota methods, the 2-hour fermentation method ranks the varieties better as compared with the averages of all 8 methods. Regent, Newthatch, and Cadet rank highest (2-hour fermentation method) in the Eastern Composite and Thatcher, Cadet, and Pilot were best in the Western composite.

The results from the North Dakota malt-phosphate bromate method shown in table 9 are given for both the 2- and 3-hour fermentation periods. As with the Minnesota methods, the 2-hour fermentation method gave the best results. The Western Composite samples baked by the North Dakota 2-hour fermentation method averaged higher than the Eastern Composite samples in loaf volume. The Western Composite samples averaged about 2 percent higher in protein content than the Eastern Composite samples. The loaf volumes of the bread by the North Dakota methods averaged higher than the Minnesota methods. The best North Dakota method (2-hours fermentation) produced loaf volumes that were generally equal to the optimum loaf volumes by the U.S.D.A., methods. The North Dakota malt-phosphate-bromate baking method (2 and 3-hour fermentation) most always makes bread that averages poorer in grain, texture, and crumb color than the grain, texture, or crumb color of the bread by the Minnesota or U.S.D.A., methods. Thatcher, Mida, and Cadet in the Eastern Composite and Cadet and Ceres in the Western Composite appears to have greater fermentation tolerance than the other varieties as judged by a comparison of the 3-hour with the 2-hour fermentation periods. Cadet was one of the better varieties in last year's tests. The results of the 2 methods used show that the 2-hour fermentation method possibly ranked the varieties better than the 3-hour fermentation method as compared with the average ranking of all methods. Newthatch, Cadet, and Regent rank highest (2-hour fermentation method) in the Eastern composite and Newthatch, Thatcher, and Cadet in the Western Composite were best.

The results from the U.S.D.A. tests, including the No. 6 bread baking method used as one of the tests for the last seven years is shown in table 9. The individual and optimum loaf volumes are shown for all of the varieties. The optimum loaf volumes are considered as the more important data of the tests made in appraising the quality of the varieties. The optimum loaf volumes for the Eastern Composite samples averaged lower than the Western Composite samples. These results are in accordance with the results obtained by the Minnesota and North Dakota methods. In ranking the varieties the U.S.D.A. optimum loaf volumes appear to be in better agreement with the North Dakota 2-hour fermentation method and possibly the Minnesota 2-hour fermentation method than any of the other methods used. The ranking by the U.S.D.A. optimum loaf volumes is in excellent agreement with the average rank of all 8 methods. For the Eastern Composite Newthatch, Cadet, and Rival, and for the Western Composite Thatcher, Pilot, and Cadet led. Cadet was one of the best varieties last year. In the Western Composite, Thatcher and Pilot were highest in optimum loaf volume averaging above 1000 cc. and better in this respect as compared with the other varieties.





## COMMERCIAL SAMPLES

As in past years a number of commercially grown wheat samples were obtained through the Grain Branch, Production and Marketing Administration, for comparison with the varieties and strains produced in experimental plots. Fifteen such samples, representing a number of grades and types were obtained at Great Falls, Montana, and Minneapolis, and Duluth, Minnesota. The samples were composited by grade from 2593 cars of wheat grading No. 3 or better and represent the better grades of hard red spring wheats received at these markets. This is the seventh season such samples have been tested. The results are given in table 10.

These samples generally averaged lower in protein content than the experimental plots and nursery samples. The few exceptions, however, were the samples from a number of the stations in the eastern and western parts of the spring wheat area (St. Paul, Waseca, Morris, Crookston, Minnesota; Langdon, Edgeley, North Dakota; Newell, South Dakota; Laramie, Wyoming; and Akron, Colorado) that were approximately the same in protein as the commercial samples. Otherwise, the milling, baking, and chemical results do not appear to be greatly different, especially when compared with samples having approximately the same protein content and test weight. The correlation coefficient for loaf volume and protein content was high ( $r=.9459$ ).

## CORRELATION AND REGRESSIONS

Correlation coefficients ( $r$ ) for loaf volume and flour protein content of 14 varieties and strains and also the commercial samples have been calculated and are presented in table 11. Also indicated in this table is the slope of the regression line or the cubic centimeter change in loaf volume for each 1.0 percent of protein ( $b_1$ ), the average protein content of the flour and the loaf volumes of the bread, and the loaf volumes adjusted to a 13.0 percent protein basis by the means of the regression equation. The plotted regression lines for each variety and the commercial samples are shown in figures 1 and 2.

The figures show that the relation between loaf volume and protein content is generally linear. These results are in accordance with last year's (1944) results, where, with a few exceptions the points fell on or very close to the calculated regression lines. The majority of the correlation coefficients for loaf volume and flour protein coefficients for loaf volume and flour protein content were high. The highest coefficients were for Ceres, Pilot x Mida, N.N. 1756, Commercial Grades, and Marquis. These were among the highest last season. The wheats having the lowest correlation coefficients this season were Rival, Pilot x Mida, N.N. 1750 and Regent x Pilot, N.N. 1753. It should be noted that the number of samples of each variety is rather small for a study of this kind. This fact should be considered in evaluating the results.

One of the important results of this study and of interest are the differences in the level and particularly in the slope of the regression lines for the different varieties. The regression lines for the varieties and strains (4 and 5 varieties grouped together) have been included in separate graphs in figures 1 and 2 with the regression line for Thatcher repeated in each graph as a standard of comparison. The regression line (figure 1, graph 1) for Pilot is highest; with Ceres the lowest. The slope of the regression line for Henry (figure 1, graph 2) is substantially higher but not as steep as compared with the regression line for Thatcher. Only five samples of Henry were milled and baked and so not too much significance can be attached to this comparison. Mida is very similar to Thatcher with respect to the regression line and Marquis which has about the same slope is at a slightly lower level. The regression lines for many of the new and more promising strains are shown in figure 2, graph 3. Regent x Pilot, N.N. 1753 (only 5 samples examined) has a much different slope of the regression line being not as steep but considerably higher than the line for Thatcher. The regression lines for Pilot x Mida, N.N. 1756 and Mida x Pilot, N.N. 1764 are generally similar in slope and level as contrasted with the slope of the line for Thatcher. The slope of the line for Pilot x Mida, N.N. 1750 was lower and not as steep as the line compared with Thatcher. The slope of the line for Regent (figure 2 graph 4) compares favorably with the slope of the line for Thatcher, with Cadet averaging intermediate and Newthatch lower.



Table 10.--Milling, baking, and chemical results on fifteen composite commercial samples of hard red spring wheat obtained at Minneapolis, Minn., Duluth, Minn., and Great Falls, Mont., representing the 1945 crop.

Location where obtained	Samples com- posited from car lots	U. S. Grade	Test Wt.	Protein		Flour		Water absorp- tion average	Mix- ing time	Baking Methods and Loaf Volume					Wt. of Loaf	Average			
				Wheat	Flour	Yield	Ash			Milligrams of Bionate						Opt- imum	Co. Grams	Crumb Color	Grain Texture
										Lbs.	Pct.	Pct.	Pct.	0					
Great Falls, Mont. Do. Do.	404	1 D.N.S.	59.2	15.3	14.4	71.4	.43	63	1.5	856	873	874		862	870	874	85	92	
	173	1 Hvy.D.N.S.	61.1	13.7	12.8	73.1	.43	62	2.0	795	815	827		772	812	827	87	88	
	317	3 D.N.S.	56.4	16.8	15.9	70.2	.43	63	1.5	928	974	959			954	974	87	98	
Minneapolis, Minn. Do. Do. Do. Do. Do.	106	1 Hvy.D.N.S.	61.2	12.4	11.6	73.3	.43	62	2.0	699	704	698			700	704	80	83	
	238	1 D.N.S.	59.9	13.1	12.4	72.7	.43	63	2.5	781	795	744			773	795	82	83	
	100	2 D.N.S.	57.5	13.9	13.0	72.6	.43	61	2.5	815	836	778			810	836	83	88	
	114	3 D.N.S.	56.9	14.2	13.4	72.4	.47	62	2.5	813	827	821			823	827	83	90	
	116	1 N.S.	59.5	12.2	11.2	73.9	.46	61	2.5	683	695	674			684	695	83	82	
	160	2 N.S.	53.1	12.9	11.7	73.9	.45	61	2.5	753	747	732			746	753	85	83	
Duluth, Minn. Do. Do. Do. Do. Do.	136	1 Hvy.D.N.S.	61.2	12.6	11.8	76.0	.45	64	2.0	715	792	781			763	792	87	87	
	184	1 D.N.S.	59.5	13.0	12.3	73.5	.44	63	2.0	738	785	738			754	785	83	85	
	139	2 D.N.S.	58.0	13.7	13.1	73.1	.46	63	2.0	830	845	803			826	845	87	90	
	143	3 D.N.S.	57.0	15.3	14.5	70.0	.46	64	2.0	836	910	905			884	910	83	90	
	139	1 N.S.	59.6	12.6	11.7	75.1	.44	62	2.0	752	755	729			745	755	82	85	
	124	2 N.S.	53.6	12.3	11.0	75.2	.46	62	2.0	781	806	735			774	806	82	87	
Average Range			58.9	13.6	12.8	73.1	.45	62	2.1	800	804				795	812	84	87	
			4.8	4.4	4.7	6.0	.04	30	1.0	224	286				254	279	7	10	

The relative position of the regression lines appears to be a rather satisfactory measure of the relative protein quality of these varieties. From these lines, the varieties and strains can be compared with each other by the means of loaf volume taken at a medium protein level (13.0 percent) as calculated from the regression lines. The loaf volume for each variety is the point at which the regression line crosses the 13.0 percent protein value in graphs 1 and 2. These loaf volumes arranged in descending order are shown in the last column of table 11.

Protein strength or protein quality is by no means the only measure of the suitability of a wheat variety or strain for bread baking purposes. It is probably, however, the most important in relation to bread baking. Other flour properties considered important are mixing time, water absorption, oxidation, and bread grain texture, and crumb color. These quality factors are given in other tables.

Table 11.--Summary of protein content-loaf volume data.

Variety	No. of Samples	b <sub>1</sub> 1/	r 2/	Protein of flour (pct.)	Average loaf volume (CC)	Loaf volume at 13.0 percent protein content 3/
Pilot	19	58.8	.9325	12.91	893	899
Regent x Pilot NN1753	5	23.4	.6525	12.82	891	896
Henry	5	35.5	.9241	11.16	818	882
Regent	12	50.6	.9111	13.08	880	875
Rival	11	59.9	.7964	12.66	849	867
Cadet	18	43.5	.9079	13.70	897	866
Thatcher	23	48.8	.9095	13.72	892	857
Pilot x Mida NN1756	13	46.8	.9534	12.60	834	853
Mida	18	47.7	.8527	12.93	843	848
Merit x Pilot NN1764	17	41.1	.9397	13.36	859	842
Newthatch	18	40.9	.8600	14.39	890	833
Marquis	11	52.3	.9047	12.91	831	832
Ceres	9	54.4	.9857	13.66	862	824
Commercial Grades	15	52.4	.9459	12.77	812	823
Pilot x Mida NN1750	13	37.9	.8162	12.49	775	794

1/ Slope of regression line or change in loaf volume for each 1 percent of protein.

2/ Correlation coefficients for loaf volume and flour protein content.

3/ Calculated from regression equation.



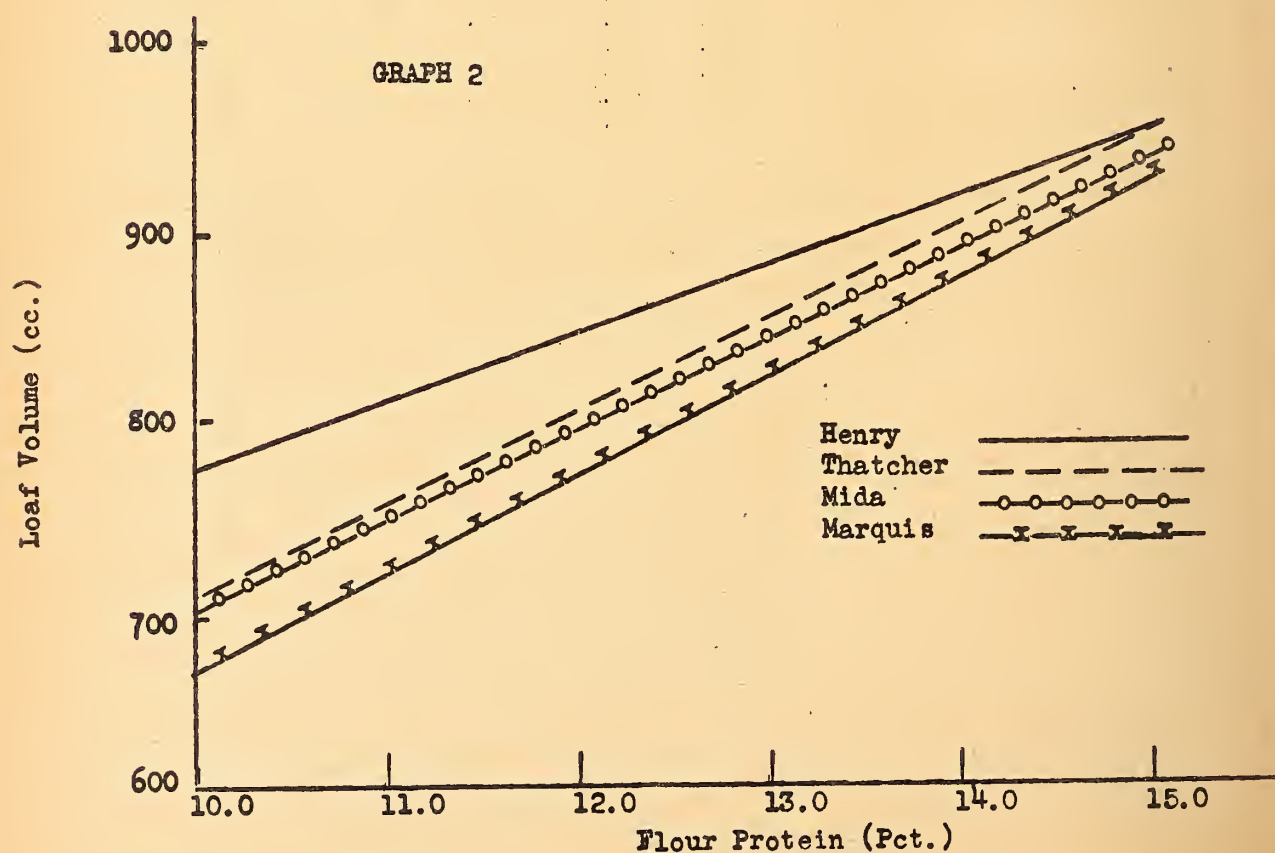
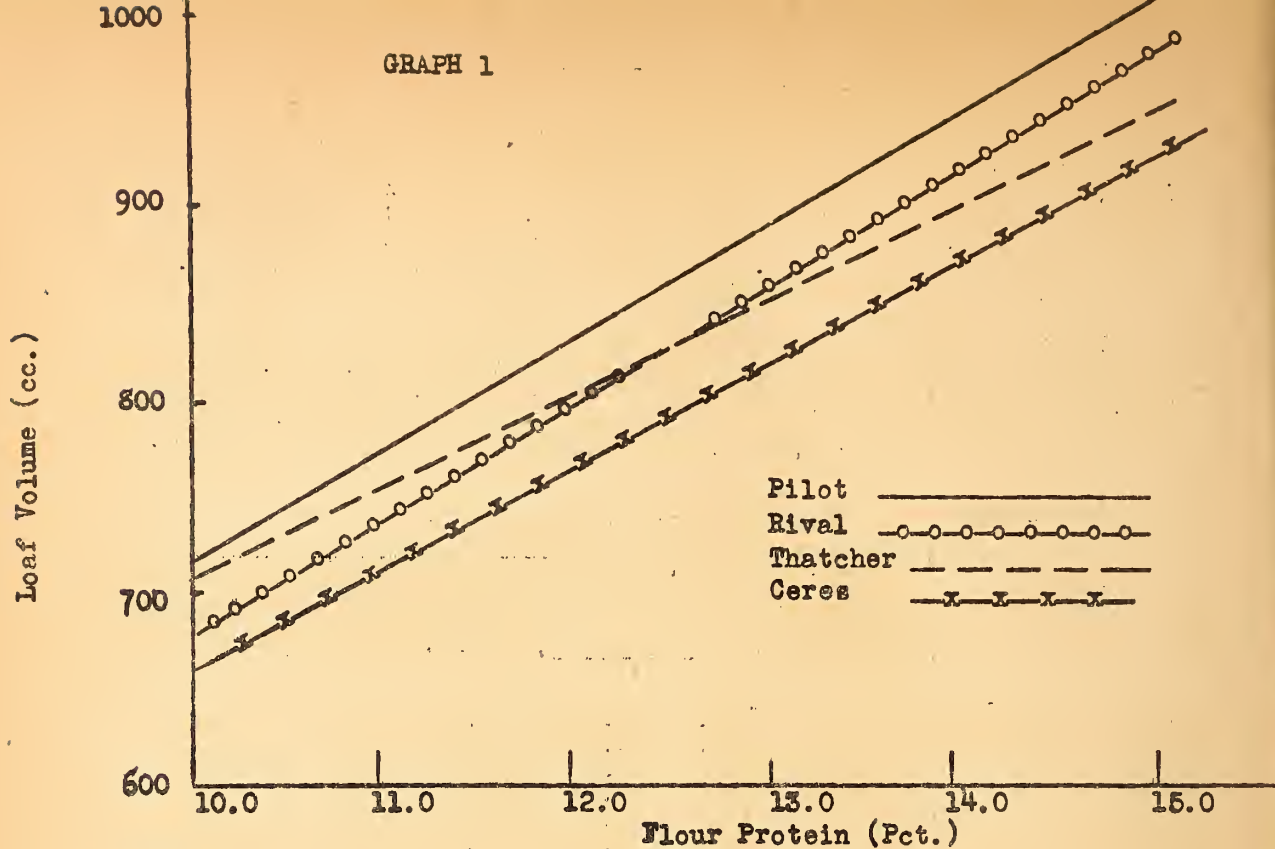


Figure 1. - Regression lines for flour protein and loaf volume for a number of hard red spring varieties and strains with Thatcher included for comparisons, 1945 crop.

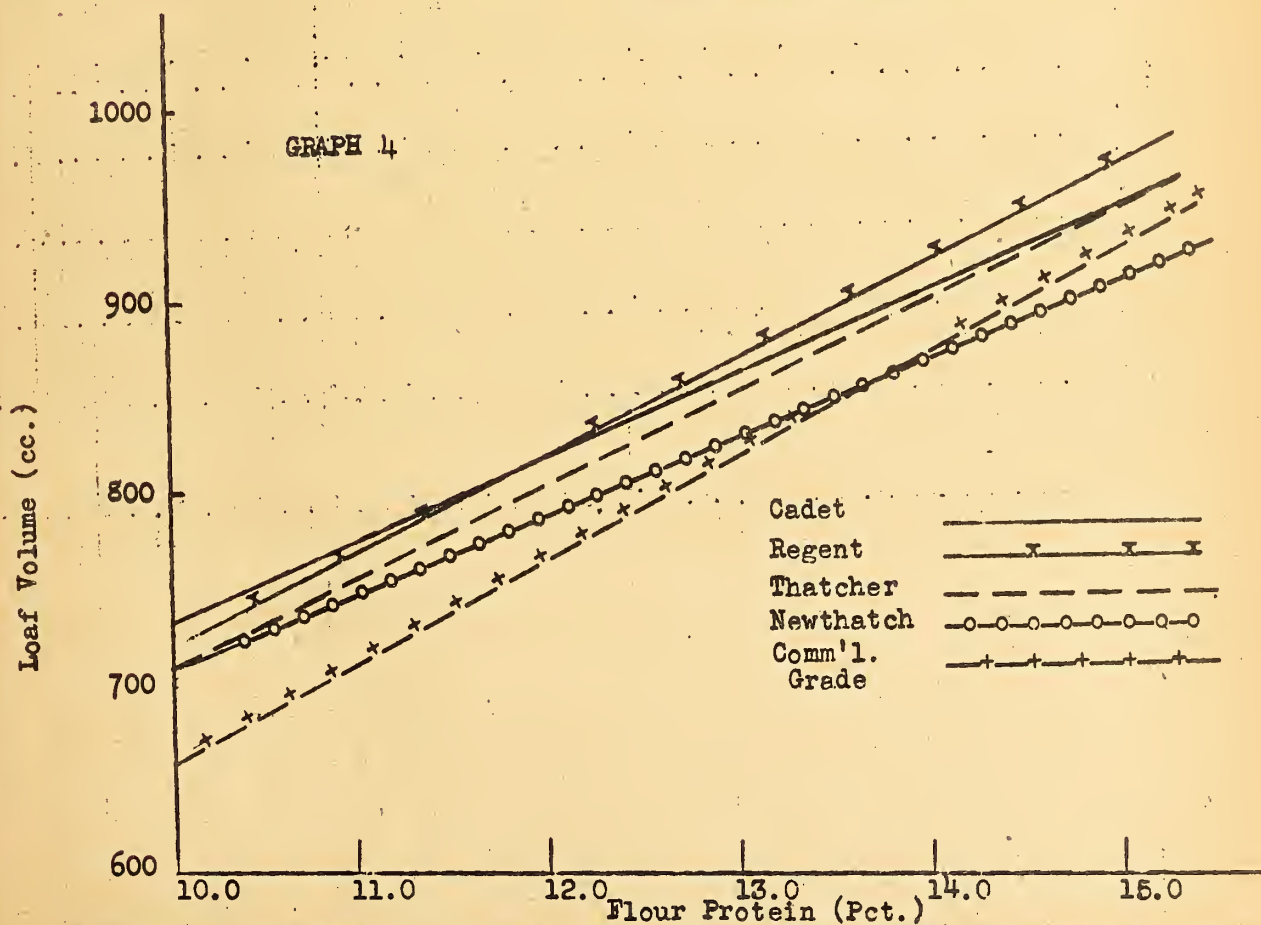
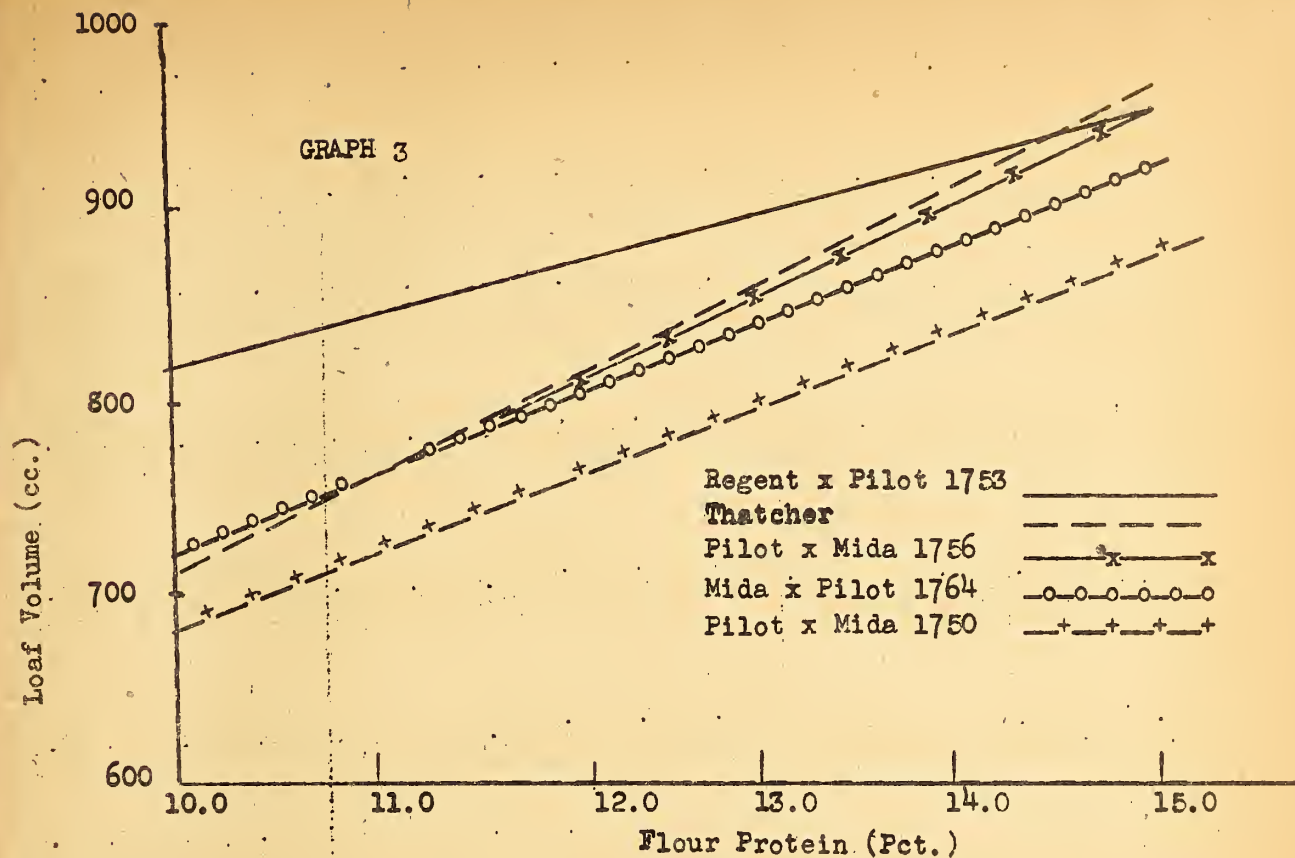


Figure 2. - Regression lines for flour protein and loaf volume for a number of hard red spring varieties and strains with Thatcher included for comparisons, 1945 crop.



Table 12.--Average of the milling, baking, and chemical properties 15 wheats, the averages of comparable samples of Thatcher, and of each variety as shown in percentage of Thatcher, with varieties arranged in order of percentage for optimum loaf volume in 1945.

Variety or Cross	No. of Samples	Yield per Acre	Test Weight		Protein		Flour		Absorption	Baking Methods and		Weight of Loaf Grams	Crumb Color	Grain Texture		
			Lbs.	Pct.	Wheat	Flour	Yield	Ash		No. 6	Average					
								Pct.			Pct.				Cc.	Cc.
N. 1556	5	25.2	60.2	14.8	13.8	72.3	.42	66	373	913	937	152	90	88		
Thatcher	5	22.3	59.2	14.3	13.6	72.2	.47	64	885	875	896	149	83	87		
Percentage of Thatcher		113.0	101.7	103.5	101.5	100.1	89.4	103.1	98.6	104.6	104.3	102.0	108.4	101.1		
Regent	12	26.0	57.5	13.8	13.0	73.0	.46	63	843	854	880	149	84	87		
Thatcher	12	25.1	57.0	13.6	12.9	72.4	.46	62	821	821	851	146	84	83		
Percentage of Thatcher		103.6	100.9	101.5	100.8	100.8	100.0	101.6	102.8	104.0	103.4	102.1	100.0	98.9		
S.D.2280	3	29.1	59.4	13.6	12.9	75.4	.43	62	827	808	845	149	87	89		
Thatcher	3	25.4	57.3	13.2	12.5	71.4	.47	63	815	811	832	146	89	88		
Percentage of Thatcher		114.6	104.7	103.0	103.2	105.6	91.5	98.4	101.5	99.6	101.6	102.1	97.8	101.1		
N. 1753	5	28.5	58.7	13.8	12.8	71.2	.49	65	880	869	891	148	83	88		
Thatcher	5	26.8	57.8	14.3	13.6	71.9	.48	63	855	848	878	148	81	87		
Percentage of Thatcher		106.3	101.6	96.5	94.1	99.0	102.1	103.2	102.9	102.5	101.5	100	102.5	101.1		
Cadet	18	25.7	56.1	14.5	13.7	71.3	.48	65	854	871	897	151	89	89		
Thatcher	18	24.7	56.4	14.3	13.6	71.9	.47	63	853	851	885	147	83	87		
Percentage of Thatcher		104.0	99.5	101.4	100.7	99.2	102.1	104.8	100.1	102.4	101.5	102.7	107.4	102.1		
Newthatch	18	25.1	55.9	15.0	14.4	72.8	.49	64	863	862	890	149	82	87		
Thatcher	18	24.8	56.5	14.3	13.6	71.9	.47	63	849	848	882	147	83	87		
Percentage of Thatcher		101.2	98.9	104.9	105.9	101.3	104.3	101.6	101.6	101.6	100.9	101.4	98.2	100.0		
Pilot	19	26.8	56.9	14.0	12.9	71.2	.45	63	869	858	892	149	87	88		
Thatcher	19	24.3	56.4	14.4	13.7	71.7	.47	63	855	856	890	148	83	87		
Percentage of Thatcher		110.3	100.9	97.2	94.1	99.3	95.7	100.0	101.6	100.2	100.3	100.7	104.8	101.1		
N. 1764	17	28.9	57.2	14.2	13.4	70.8	.52	67	820	829	859	153	86	87		
Thatcher	17	25.6	56.7	14.3	13.6	71.7	.48	63	840	843	876	147	83	87		
Percentage of Thatcher		112.9	100.9	99.3	98.5	98.7	108.3	106.3	97.6	98.4	98.0	104.1	104.2	100.0		
Rival	11	31.5	60.0	13.6	12.7	75.7	.49	65	822	826	849	150	88	90		
Thatcher	11	25.1	56.9	13.8	13.1	72.5	.46	62	830	831	861	146	83	88		
Percentage of Thatcher		125.5	105.4	98.6	96.9	104.4	106.5	104.8	99.0	99.4	98.6	102.7	104.9	101.6		
Henry	5	36.6	58.1	12.3	11.2	75.4	.45	62	808	801	818	149	78	86		
Thatcher	5	26.3	55.5	13.1	12.4	72.2	.48	62	812	808	837	146	80	89		
Percentage of Thatcher		139.2	104.7	93.9	90.3	104.4	93.8	100.0	99.5	99.2	97.7	102.1	96.8	96.6		
Mida	18	29.9	60.0	13.8	12.9	74.6	.44	64	821	817	843	151	90	88		
Thatcher	18	24.8	56.5	14.3	13.6	71.9	.47	63	849	848	882	147	83	87		
Percentage of Thatcher		120.6	106.2	96.5	94.9	103.8	93.6	101.6	96.7	95.6	96.3	102.7	108.1	101.3		
N. 1756	13	28.7	59.6	13.5	12.6	72.9	.43	63	813	809	834	150	89	88		
Thatcher	13	24.8	56.7	14.3	13.6	71.4	.48	63	851	850	882	147	82	87		
Percentage of Thatcher		115.7	105.1	94.4	92.6	102.1	87.5	100.0	95.5	94.6	95.2	102.0	108.4	101.8		
Ceres	9	23.4	58.0	14.4	13.7	70.8	.46	65	838	862	828	152	82	85		
Thatcher	9	23.8	56.2	15.2	14.4	71.3	.49	63	879	877	921	148	84	86		
Percentage of Thatcher		98.3	103.2	94.7	95.1	99.3	93.9	103.2	95.4	93.6	94.4	102.7	98.3	99.5		
Margus	11	28.2	57.2	14.5	13.8	70.9	.46	63	860	858	890	149	83	87		
Thatcher	11	26.9	56.4	14.6	13.9	71.2	.47	63	845	845	893	148	83	87		
Percentage of Thatcher		89.4	101.6	95.2	93.5	98.2	93.9	100.0	94.8	94.5	93.4	101.4	100.0	100.0		
N. 1750	13	30.3	60.7	13.5	12.5	73.4	.45	64	758	749	775	151	87	85		
Thatcher	13	26.9	57.3	13.9	13.2	72.0	.47	63	832	828	854	147	82	85		
Percentage of Thatcher		112.6	105.9	97.1	94.7	101.9	95.7	101.6	91.2	90.5	90.7	102.7	105.7	96.9		

Table 13.--Annual and total number of samples comparable with Thatcher and weighted average milling, baking, and chemical properties expressed in percentage of Thatcher for the 8 years, 1938 to 1945.

Variety State or Nursery No.	Crop year and number of samples								Total
	1938	1939	1940	1941	1942	1943	1944	1945	
Thatcher	11	12	14	16	18	20	18	23	132
Pilot	8	11	14	13	14	14	16	19	109
Rival	8	9	9	13	11	12	10	11	83
Cadet	---	---	2	10	16	13	14	18	73
Mida	---	2	9	10	7	8	14	18	68
Regent	2	4	7	10	9	12	10	12	66
Newthatch	---	---	2	9	12	12	14	18	65
Marquis	2	4	8	9	9	8	9	11	80
Ceres	4	3	6	7	6	7	8	9	50
N. No. 1764	---	---	---	---	---	2	13	17	32
N. No. 1756	---	---	---	---	---	4	7	13	24
N. No. 1750	---	---	---	---	---	3	8	13	24
Henry	---	---	---	---	3	6	6	5	20
S. D. 2280	---	---	---	---	4	4	2	3	13
N. No. 1753	---	---	---	---	---	3	5	5	13
N. No. 1556	---	---	---	---	---	4	4	5	13

Variety State or Nursery No.	Test weight per bushel								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1750	---	---	---	---	---	106.6	104.9	105.9	105.7
Mida	---	104.8	105.6	107.9	106.5	104.1	102.9	106.2	105.4
N. No. 1756	---	---	---	---	---	105.5	104.1	105.1	104.9
S.D. 2280	---	---	---	---	101.4	103.6	103.1	104.7	103.1
Henry	---	---	---	---	102.4	103.0	101.4	104.7	102.8
Rival	105.1	100.7	100.2	103.6	102.6	101.0	100.3	105.4	102.4
N. No. 1753	---	---	---	---	---	102.3	101.7	101.6	101.8
Ceres	102.1	102.5	98.4	103.2	101.2	100.3	101.5	103.2	101.5
N. No. 1556	---	---	---	---	---	101.4	100.7	101.7	101.3
Pilot	100.9	100.0	100.5	102.3	101.5	100.2	100.0	100.9	100.7
Regent	101.5	97.0	98.6	102.6	102.3	100.9	99.3	100.9	100.7
N. No. 1764	---	---	---	---	---	102.0	99.8	100.9	100.5
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Marquis	100.0	100.7	96.1	99.5	102.3	100.9	98.9	101.6	100.0
Cadet	---	---	98.3	100.4	101.0	98.5	99.7	99.5	99.8
Newthatch	---	---	99.3	101.3	101.0	98.5	99.3	98.9	99.6

Variety State or Nursery No.	Crude protein content of the wheat								Average
	1938	1939	1940	1941	1942	1943	1944	1945	
Newthatch	---	---	102.4	108.9	107.8	106.1	104.4	104.9	105.9
Regent	106.0	103.1	102.5	106.8	106.1	104.7	104.6	101.5	104.3
Cadet	---	---	100.0	104.8	104.9	103.6	101.5	101.4	103.0
S.D. 2280	---	---	---	---	104.8	101.9	100.7	103.0	102.9
N. 1556	---	---	---	---	---	102.0	101.5	103.5	102.4
N. No. 1753	---	---	---	---	---	104.6	102.8	96.5	100.8
N. No. 1764	---	---	---	---	---	101.9	101.5	99.3	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mida	---	97.6	95.6	102.0	102.1	107.6	98.5	96.5	99.5
Rival	100.0	94.2	97.5	100.7	100.7	101.3	100.8	98.6	99.4
Pilot	102.0	94.2	100.0	100.7	98.6	99.3	97.0	97.2	98.4
N. No. 1750	---	---	---	---	---	100.6	98.5	97.1	98.0
Ceres	98.6	95.7	97.4	97.5	93.1	101.3	97.9	94.7	97.7
Marquis	100.0	95.1	93.2	96.9	96.0	94.4	95.7	95.2	95.4
N. No. 1756	---	---	---	---	---	97.3	94.3	94.4	94.9
Henry	---	---	---	---	97.8	95.3	92.6	93.9	94.5



Table 13.--Continued

Variety State or Nursery No.	Yield of Flour								Weighted Average
	1933	1939	1940	1941	1942	1943	1944	1945	
Henry	---	---	---	---	102.8	102.5	102.4	104.4	103.0
Rival	105.5	102.7	99.4	103.1	101.2	103.4	101.9	104.4	102.7
Mida	---	100.7	102.3	102.5	102.7	101.9	102.1	103.3	102.6
S.D. 2280	---	---	---	---	101.7	101.7	101.0	105.6	102.5
Newthatch	---	---	102.5	100.9	101.7	101.4	101.2	101.3	101.4
N. No. 1750	---	---	---	---	---	99.7	100.4	101.9	101.1
N. No. 1756	---	---	---	---	---	99.6	99.9	102.1	101.0
Regent	100.9	98.4	100.0	100.9	99.7	102.3	99.5	100.3	100.6
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cadet	---	---	99.3	99.6	100.0	100.8	99.2	99.2	99.7
Ceres	102.4	100.3	95.8	100.7	99.0	100.3	99.5	99.3	99.5
N. No. 1556	---	---	---	---	---	98.5	99.3	100.1	99.4
Pilot	98.5	99.3	98.2	99.4	99.9	99.7	98.1	99.3	99.1
N. No. 1764	---	---	---	---	---	96.9	98.2	98.7	98.4
N. No. 1753	---	---	---	---	---	97.2	97.1	99.0	97.8
Marquis	100.0	98.3	94.2	92.9	98.7	99.3	97.2	98.2	97.0

Variety State or Nursery No.	Ash in Flour								Weighted Average
	1933	1939	1940	1941	1942	1943	1944	1945	
N. No. 1764	---	---	---	---	---	109.2	104.0	108.3	106.6
Cadet	---	---	123.9	113.5	105.7	107.1	100.0	102.1	105.5
Newthatch	---	---	126.1	111.5	101.9	107.1	102.0	104.3	105.3
Rival	96.1	104.0	107.5	105.3	98.1	109.1	101.9	106.5	103.9
Marquis	100.0	101.9	107.5	109.4	103.8	110.2	100.0	93.9	103.4
Regent	104.0	111.3	115.4	103.8	92.3	100.0	98.1	100.0	101.6
N. No. 1753	---	---	---	---	---	103.6	95.9	102.1	100.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ceres	98.0	103.8	93.1	103.8	96.2	100.0	100.0	93.9	98.2
Pilot	100.0	98.0	100.0	101.9	96.2	98.1	90.0	95.7	97.1
Mida	---	85.5	100.0	105.9	92.3	94.7	96.1	93.6	96.5
N. No. 1750	---	---	---	---	---	96.3	96.1	95.7	95.9
N. No. 1556	---	---	---	---	---	101.9	96.1	89.4	95.3
S.D. 2280	---	---	---	---	101.7	93.1	90.0	91.5	94.9
Henry	---	---	---	---	87.7	93.1	90.6	93.8	91.7
N. No. 1756	---	---	---	---	---	100.0	86.0	87.5	89.2

Variety State or Nursery No.	Water Absorption of Flour								Weighted Average
	1933	1939	1940	1941	1942	1943	1944	1945	
N. No. 1764	---	---	---	---	---	109.2	106.3	106.3	106.5
Cadet	---	---	109.2	104.8	106.7	104.2	104.7	104.8	105.3
N. No. 1753	---	---	---	---	---	105.4	103.1	103.2	103.7
Rival	103.9	100.5	102.2	103.2	105.0	102.7	101.6	104.3	103.1
N. No. 1556	---	---	---	---	---	101.6	101.7	103.1	102.2
N. No. 1750	---	---	---	---	---	101.7	101.6	101.6	101.6
Ceres	102.9	97.7	101.5	103.2	101.6	100.3	100.0	103.2	101.5
Newthatch	---	---	104.6	101.1	102.1	100.6	100.0	101.6	101.2
S.D. 2280	---	---	---	---	100.0	103.3	103.1	98.4	101.1
Regent	100.7	99.1	100.5	101.6	101.6	99.4	98.4	101.6	100.5
Mida	---	97.3	99.8	98.4	101.6	100.5	100.0	101.6	100.4
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	97.3	98.9	100.5	100.0	100.0	98.5	98.4	100.0	99.3
N. No. 1756	---	---	---	---	---	98.4	98.4	100.0	99.3
Henry	---	---	---	---	100.0	99.3	98.4	100.0	99.3
Marquis	100.0	94.8	97.1	100.0	100.0	97.4	96.9	100.0	98.4

Table 13.--Continued

Variety State or Nursery No.	Leaf Volume, Method No. 6								
	1938	1939	1940	1941	1942	1943	1944	1945	Average
N. No. 1753	--	--	--	--	--	107.7	106.8	102.9	105.4
Newthatch	--	--	97.4	103.7	103.3	99.4	103.4	101.6	102.0
Regent	109.8	100.1	99.9	105.0	103.6	95.0	105.6	102.8	102.0
S.D. 2230	--	--	--	--	104.8	98.6	94.1	101.5	100.5
Cadet	--	--	97.9	102.2	100.5	97.1	103.0	100.1	100.4
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	97.3	95.8	98.0	99.6	101.1	100.6	98.9	101.6	99.5
N. No. 1764	--	--	--	--	--	96.1	101.9	97.6	99.2
Rival	95.4	94.2	90.3	97.1	101.7	99.6	106.8	99.0	98.3
Ceres	95.6	91.9	89.9	99.1	100.2	102.6	96.6	95.4	96.9
Henry	--	--	--	--	99.2	90.8	96.7	99.5	96.0
Marquis	94.2	90.9	90.0	99.3	95.3	96.0	99.1	94.8	95.5
Mida	--	87.7	88.8	91.5	98.4	98.6	98.8	96.7	95.5
N. 1556	--	--	--	--	--	85.3	99.9	98.8	94.9
N. No. 1756	--	--	--	--	--	90.4	96.0	95.5	94.8
N. No. 1750	--	--	--	--	--	86.9	91.6	91.2	90.8

Variety State or Nursery No.	Leaf Volume, Average								
	1938	1939	1940	1941	1942	1943	1944	1945	Average
N. No. 1753	--	--	--	--	--	103.7	106.6	102.5	104.3
Newthatch	--	--	97.8	102.2	102.6	99.8	101.6	101.6	101.4
Regent	101.6	98.6	99.8	102.8	101.9	94.4	106.0	104.0	101.2
Pilot	102.7	97.3	99.0	100.1	103.0	103.4	97.3	100.2	100.3
Cadet	--	--	97.7	100.2	98.4	94.9	104.1	102.5	100.1
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
S.D. 2230	--	--	--	--	104.4	96.7	96.5	99.6	99.7
N. No. 1764	--	--	--	--	--	94.8	101.3	98.4	99.4
Rival	99.0	94.0	91.0	95.9	101.0	100.0	104.1	99.4	98.2
Ceres	98.7	97.2	95.4	98.1	101.8	103.9	95.3	93.6	97.8
N. 1556	--	--	--	--	--	85.0	101.7	104.6	97.7
Marquis	96.5	93.6	91.9	98.1	95.6	98.3	98.5	94.5	96.0
Henry	--	--	--	--	96.5	89.5	97.6	99.2	95.4
Mida	--	91.5	89.2	91.9	92.6	98.8	96.4	95.6	94.9
N. No. 1756	--	--	--	--	--	92.5	94.2	94.6	94.1
N. No. 1750	--	--	--	--	--	87.7	91.3	90.5	90.4

Variety State or Nursery No.	Leaf Volume, Optimum								
	1938	1939	1940	1941	1942	1943	1944	1945	Average
N. No. 1753	--	--	--	--	--	107.0	105.9	101.5	104.5
Regent	106.6	99.7	100.5	104.9	103.1	95.3	105.9	103.4	102.0
Newthatch	--	--	97.4	103.4	103.0	99.9	101.6	100.9	101.4
S.D. 2230	--	--	--	--	104.7	98.9	97.2	101.6	101.0
Cadet	--	--	97.9	101.5	100.0	97.2	104.1	101.5	100.8
Pilot	99.3	96.0	98.5	100.0	101.4	100.6	97.8	100.3	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N. No. 1764	--	--	--	--	--	96.1	100.8	98.0	99.0
Rival	97.3	93.9	92.1	96.6	101.2	99.8	104.2	98.6	98.2
N. No. 1556	--	--	--	--	--	85.3	102.3	104.3	97.8
Ceres	97.3	91.9	90.2	99.4	100.8	102.6	95.1	94.4	96.7
Henry	--	--	--	--	98.9	90.8	97.3	97.7	95.8
Marquis	94.3	90.9	91.9	98.8	95.7	96.2	99.9	93.4	95.4
Mida	--	88.4	89.0	91.4	98.2	98.6	96.4	96.3	94.9
N. No. 1756	--	--	--	--	--	90.4	94.9	95.2	94.3
N. No. 1750	--	--	--	--	--	86.9	90.9	90.7	90.3



Table 13.--Continued

Variety State or Nursery No.	Crumb Color, Average								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1756	--	--	--	--	--	108.6	107.2	108.4	108.1
Mida	--	103.8	103.6	111.1	107.0	108.4	105.9	103.1	107.4
N. No. 1750	--	--	--	--	--	111.3	105.9	105.7	106.5
Cadet	--	--	101.1	111.1	105.8	100.0	105.9	107.4	105.7
Pilot	109.5	101.7	100.1	103.6	105.8	106.0	103.5	104.8	104.2
N. No. 1764	--	--	--	--	--	103.9	102.3	104.2	103.7
Rival	108.9	98.2	96.4	103.6	105.8	104.8	104.7	104.9	103.5
N. No. 1556	--	--	--	--	--	97.5	102.4	108.4	103.2
N. No. 1753	--	--	--	--	--	106.2	98.0	102.5	101.6
Marquis	92.6	104.2	100.0	100.0	104.6	106.2	97.6	100.0	101.1
S. D. 2280	--	--	--	--	103.4	102.5	97.7	97.8	101.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Regent	97.5	95.7	97.7	103.7	103.5	92.8	102.4	100.0	99.5
Newthatch	--	--	94.3	107.6	100.0	96.4	93.8	98.2	99.2
Ceres	95.3	100.0	95.2	100.0	100.0	92.8	101.2	93.3	98.3
Henry	--	--	--	--	90.0	91.5	89.8	96.8	92.1

Variety State or Nursery No.	Grain Texture, Average								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
S. D. 2280	--	--	--	--	102.2	104.9	102.2	101.1	102.8
N. No. 1756	--	--	--	--	--	104.8	102.3	101.8	102.4
Pilot	104.6	99.9	97.0	101.2	102.3	103.6	102.3	101.1	101.5
Cadet	--	--	94.4	102.3	101.1	97.6	104.7	102.1	101.4
Mida	--	103.4	97.8	101.1	101.1	104.7	101.2	101.3	100.8
N. No. 1764	--	--	--	--	--	103.8	100.0	100.0	100.6
Rival	99.3	99.0	94.3	101.2	101.1	103.6	102.3	101.6	100.6
Newthatch	--	--	96.6	100.0	101.1	100.0	101.2	100.0	100.4
N. No. 1753	--	--	--	--	--	101.2	99.0	101.1	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Marquis	91.1	100.2	98.9	100.0	100.0	102.5	100.0	100.0	99.9
Ceres	93.7	103.7	95.3	101.2	98.8	103.7	101.1	99.5	99.7
N. No. 1750	--	--	--	--	--	104.9	97.7	96.9	98.2
Regent	95.9	93.5	93.3	98.9	100.0	96.4	102.3	98.9	98.1
N. 1556	--	--	--	--	--	92.9	98.9	101.1	97.9
Henry	--	--	--	--	98.8	96.4	96.6	96.6	96.9

Variety State or Nursery No.	Summary of all tests for seven properties							
	Test Weight	Wheat Protein	Flour Yield	Absorp- tion	Opt. Volume	Crumb Color	Grain Texture	Average 7 Properties
Cadet	99.3	103.0	99.7	105.3	100.3	105.7	101.4	102.2
S. D. 2280	103.1	102.9	102.5	101.1	101.0	101.0	102.8	102.1
Mida	105.4	99.5	102.6	100.4	94.9	107.4	100.8	101.6
N. 1753	101.8	100.8	97.3	103.7	104.5	101.6	100.3	101.5
Rival	102.4	99.4	102.7	103.1	98.2	103.5	100.6	101.4
Newthatch	99.6	105.9	101.4	101.2	101.4	99.2	100.4	101.3
N. 1764	100.5	100.3	98.4	106.5	99.0	103.7	100.6	101.3
Regent	100.7	104.3	100.6	100.5	102.0	99.5	98.1	100.8
N. 1756	104.9	94.9	101.0	99.3	94.3	103.1	102.4	100.7
N. 1556	101.3	102.4	99.4	102.2	97.8	103.2	97.9	100.6
Pilot	100.7	98.4	99.1	99.3	100.3	104.2	101.5	100.5
N. 1750	105.7	98.0	101.1	101.6	90.3	106.5	98.2	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ceres	101.5	97.7	99.5	101.5	96.7	98.2	99.7	99.3
Marquis	100.0	95.4	97.0	92.4	95.4	101.1	99.9	99.2
Henry	102.8	94.5	103.0	99.3	95.8	92.1	96.9	97.8

## COMPARABLE SAMPLES WITH THATCHER: 1945

In table 12, the properties of the 1945 samples of 15 varieties or strains of hard red spring wheat are compared with those of Thatcher grown in the same tests. The varieties are arranged in order of percentage for the optimum loaf volume.

## COMPARABLE SAMPLES 1933 to 1945

Table 13 gives the averages (3 to 8 years) of the milling, baking, and chemical properties of 15 varieties and strains, expressed as a percentage of comparable samples of Thatcher. These include the leading commercial varieties grown in the region and the most promising new hybrid strains that have been tested. From 13 to 132 comparisons were made for these wheats. The more important quality comparisons were made for these wheats. The more important quality comparisons shown in the summary table 13 discussed in relation to Thatcher as 100 percent.

### Thatcher

Thatcher has been a uniform variety in the plot experiments since 1932. It was distributed for commercial growing in 1934. It is resistant to stem rust, is early, has short, strong straw and yields well. Its commercial acreage increased rapidly until it became the most widely grown variety in 1938. It probably reached its peak in 1941 when it was grown on about 6 million acres in the United States and 9 or 10 million acres in Canada. Being susceptible to leaf rust, it was injured severely in 1938, 1939, and again in 1941 and its acreage has since decreased in the United States giving way to Rival and Pilot in the leaf-rust-affected sections. Thatcher replaced Marquis as a standard of comparison in 1939 and as it is still the most widely grown hard red spring variety it is here used as the standard of comparison for the different milling and baking properties.

These tests show Thatcher to average about medium in test weight being exceeded by a number of the commercially acceptable varieties. It has shown excellent milling qualities producing a high percentage of flour and somewhat better than would be expected from its test weight. The protein content is medium to high and the flour ash about average as compared with the flour ash from a number of other commercially grown varieties. The quality of the protein is strong. Thatcher has excellent baking qualities in experimental baking tests and is preferred by the grain trade for a strong type bakers' flour. It ranks high in loaf volume of bread, has good grain-texture, satisfactory but only medium crumb color and a reasonably high water absorption. The 1945 correlation coefficient for flour protein-loaf volume was high ( $r=.9095$ ) and the slope of the regression line ( $b_1=48.8$  cc). In table 13 are summarized the data from 3 to 8 years tests, giving the relative rank of 15 wheats in percentage of Thatcher, for the principal milling and baking properties.

### Pilot

Pilot has been a uniform variety in plot experiments since 1936 and commercially grown since 1939. It has shown excellent milling and baking qualities in experimental baking tests and is approved by the grain trade for a strong type flour. Pilot is resistant to both stem and leaf rust, to mildew, bunt and some of the footrots. It has been the highest yielding of the uniform varieties during the past 8 years, ranking first in five of the years. It ranked fourth in quality in the Eastern composite and second in the Western composite during the four year period 1942 to 1945 inclusive. The weighted average of 109 comparable samples for 8 years shows Pilot exceeds Thatcher with respect to test weight and average and optimum loaf volume of bread. Pilot has made bread that has averaged (8 years) considerable better than Thatcher in grain texture and crumb color. It has been uniformly low in flour ash content and exceeded many of the uniform varieties in this respect. The quality of the protein of Pilot is good. Pilot averages slightly lower in flour protein content than Thatcher, but is equal to Thatcher in loaf volume of bread for the average of 8 years tests (table 2). Pilot has a short dough mixing time. It averages slightly lower than Thatcher for the other properties. In supplemental baking tests Pilot does not usually respond to increasing amounts of bromate and is easily injured by long fermentation. The dough properties of Pilot are elastic and pliable as contrasted with some varieties which produce bueky doughs. The correlation coefficient for flour protein-loaf volume was high ( $r=.9325$ ) and the slope of the regression line ( $b_1$ ) equals 58.8.



### Rival

Rival was made a uniform variety in 1938 and together with Pilot was distributed for commercial growing in 1939. By 1944 they had increased to 6 million acres, with Rival exceeding Pilot about 3 to 1. Rival has shown good milling and baking qualities in experimental baking tests and is considered satisfactory by the grain trade. Both Pilot and Rival are awned wheats and do not have as strong straw as desired for the heavier soils in the eastern section. Among the uniform varieties Rival has yielded less than Pilot but more than Thatcher during the past 8 years for the region, and has yielded much better in the eastern than in the western sections. The weighted average of 83 comparable samples for 8 years show Rival to exceed Thatcher with respect to test weight, flour yield, water absorption, crumb color and grain texture.

It is among one of the varieties high in flour ash. It has been outstanding as to yield of flour ranking better than most of the varieties and strains grown over a period of years. Of the 16 wheats shown in table 13, it ranks 9th in optimum loaf volume and 5th for the average of 7 principal properties. The correlation coefficient for flour protein-loaf volume was ( $r=.7964$ ) and the slope of the regression line ( $b_1$ ) equals 59.9 was steeper than that of any of the 15 wheats with which it was compared.

### Cadet

Cadet has been a uniform variety for the region for the 4 years 1942 to 1945. It is the result of a Merit x Thatcher cross and was increased in 1944 and distributed for commercial growing in 1945. Cadet is a midseason, awnleted wheat resistant to both stem and leaf rusts. It has been a high yielding wheat for the region but appears best adapted to the northern part. During a 6-year period 83 comparable milling and baking tests show it to exceed Thatcher with respect to crude protein content of wheat, water absorption, loaf volume for the No. 6, average, and optimum, crumb color, and grain texture. It is approximately equal to Thatcher in test weight and flour yield, has a higher ash in the flour and a much greater water absorption. Supplemental baking tests show that it responds sharply to increasing amounts of bromate and generally has greater tolerance to long periods of mixing and fermentation than most varieties. It has ranked high by the malt-phosphate-bromate bake used by the North Dakota, and Canadian laboratories. Commercial milling and baking tests for the last 4 years rank it high in quality. Among the 16 wheats it ranks 3rd in crude protein of wheat, 2nd in water absorption, 5th in loaf volume by the No. 6 method and optimum bake, 4th in crumb color, and grain texture and 1st for the average of 7 principal properties. The 1945 correlation coefficient for flour protein-loaf volume was medium high ( $r=.9097$ ) and the slope of the regression line ( $b_1$ ) equals 43.5.

### Mida

Mida was first made a uniform variety for the region in 1944 when it was distributed for commercial growing by the North Dakota Agricultural Experiment Station. It has been in plot experiments at the North Dakota and Minnesota stations for 6 years and was the highest yielding wheat for the region in 1945. It is an awned, strong-strawed wheat, resistant to both stem and leaf rusts and to bunt. During 7 years 68 milling and baking tests show that it exceeds Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption, crumb color, and grain texture and has a lower ash content of the flour. In loaf volume Mida ranked lower than Thatcher by the No. 6, average, and optimum baking results. It ranked 14th, according to the optimum bake and 13th by the No. 6 and 14th by the average results, among 16 wheats. It averages 3rd in yield of flour and 2nd in crumb color and test weight. The summary of 7 principal properties shows it to rank 3rd. It has commercial trade approval as satisfactory for all-purpose bakers' flour. The correlation coefficient flour protein-loaf volume ( $r$ ) was .8527 and the slope of the regression line ( $b_1$ ) medium, 47.7.

### Regent

Regent has been a uniform variety since 1942. It was developed and distributed by the Canadian Department of Agriculture in 1939 and has been grown commercially in the United States since 1940. It is recommended for growing on the heavier soils of the Red River Valley of Minnesota and North Dakota. In other areas, however, it has been damaged by heat and scab and has not been a high-yielding wheat. It has shown excellent milling and baking qualities in experimental tests and has been approved by the commercial grain trade. Sixty-six comparable tests with Thatcher covering 8 years show it to exceed Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption, loaf volume for the average, No. 6, and optimum, but lower in other properties. It is higher in ash of flour than Thatcher.

Regent has been particularly high in protein exceeding many of the wheats with which it has been comparably grown. The better loaf volume obtained from Regent indicates that the quality of the protein is also good. It has about the same dough mixing time as Thatcher. Regent averages 8th in the summary of 7 principal properties. The correlation coefficient for flour-protein-loaf volume was ( $r=.9111$ ) and the slope of the regression line ( $b_1$ ) equals 50.0.

#### Newthatch

Newthatch is a composite of several Hope x Thatcher<sup>3</sup> backcross strains, one of which was a uniform variety for the eastern section in 1942. In 1943 Newthatch replaced the single line as a uniform variety for the eastern section and was made a uniform variety for the region in 1944. The variety was distributed to seed growers by the Minnesota Agricultural Experiment Station in 1944. In the Minnesota plot experiments for 5 years, Newthatch has outyielded the other uniform varieties but for the region it is not high. By using yields and milling and baking data for the single lines included in the composite, data are available for a 6-year period. During a 6-year period of 65 comparable milling and baking tests, Newthatch has exceeded Thatcher with respect to crude protein of wheat, flour yield, water absorption, and loaf volume, (No. 6, average and optimum) and grain texture. It has a high ash content, ranking 3rd in comparison with 16 wheats. It has one outstanding advantage in being highest in protein content of the wheat, and averages 3rd in optimum loaf volume among 16 wheats. It is about the same in test weight as Thatcher but yields slightly more flour than Thatcher on a yearly basis for the 6 years compared. The dough mixing time is similar to that of Thatcher. It ranks 6th for the average of 7 principal properties. The 1945 correlation coefficient for flour protein-loaf volume was not as high as some of the other varieties ( $r=.8600$ ) and the slope of the regression line rather low ( $b_1$ ) equals 40.9.

#### Marquis

Marquis was a uniform variety for the region from 1929 to 1942 and is still one of the uniform varieties for the western section. It was the leading spring wheat variety of the United States from 1919 to 1934. It was long considered the standard of quality, but since 1938 has been replaced by Thatcher. Marquis is still held in high regard by the commercial trade, although in comparison with newer varieties it has not shown to advantage in experimental yield and quality tests. It is the lowest yielding of the uniform varieties. Among the 16 wheats, 60 comparable samples of Marquis and Thatcher show Marquis to be lower than Thatcher in flour yield, water absorption, crude protein, loaf volume (No. 6, average and optimum) and grain texture. It is higher than Thatcher for crumb color and also higher in ash content of flour. It ranks 13th for optimum loaf volume and 15th in the summary of the 7 principal properties among the 16 wheats. The correlation coefficients for flour protein-loaf volume was high ( $r=.9407$ ) and the slope of the regression line ( $b_1$ ) equals 52.3.

#### Ceres

Ceres has been a uniform variety since the start of the coordinated regional program in 1929. It was distributed in 1926 and increased rapidly, exceeding Marquis in acreage by 1934. In the bad rust years of 1935, 1937, and 1938 it was severely damaged and was gradually replaced by Thatcher. It is still a high-yielding wheat in most of Montana and other sections where stem and leaf rusts do not occur too frequently. Ceres has consistently shown good milling and baking qualities in experimental tests and has been accepted by the commercial trade. Among the uniform varieties for the western section Ceres has been outyielded by both Thatcher and Pilot. Among the 16 wheats summarized in table 13, 50 comparable samples of Ceres and Thatcher covering 8 years, show Ceres exceeds Thatcher with respect to test weight and water absorption. It averages slightly lower than Thatcher for the other properties but ranks 10th for the No. 6 and average loaf volume and 11th for optimum volume among 16 wheats. It ranks 13th in protein content and 14th for the average of 7 of the principal properties. The correlation coefficient for flour protein-loaf volume was one of the highest ( $r=.9857$ ) and the slope of the regression line medium high ( $b_1$ ) equals 54.4.



N. No. 1764

N. No. 1764 is Merit x Pilot, (C.I. 12315) and was the 2nd highest yielding wheat in the Uniform Regional Nurseries for the 3 years 1943 to 1945. It has been advanced to plot experiments at most stations. It is an early bearded wheat with good strength of straw. It also is resistant to stem and leaf rust, bunt, mildew, and scab. During the last 3 years 32 comparable milling and baking tests show it exceeds Thatcher with respect to test weight, crude protein content, water absorption, crumb color, and grain texture. It has the highest ash content of flour among the varieties compared and the flour yield is relatively low, ranking 14th. It appears to be outstanding on the basis of 3 years results in water absorption ranking 1st among 16 varieties. The dough mixing time is slightly longer than required for Thatcher. It ranks 7th among 16 varieties for an average of 7 principal properties. It appears to be one of the outstanding strains tested during the last 3 years. The correlation coefficient ( $r=.9397$ ) for flour-protein loaf volume was as high as for many of the other comparisons. The slope of the line ( $b_1$ ) was 41.1.

N. No. 1756

N. No. 1756 is Pilot x Mida (C.I. 12303) and has been the highest yielding wheat in the Uniform Regional Nursery for 3 years 1943 to 1945 inclusive. It has been advanced to plot tests at a large number of stations because of high yield and heavy test weight kernels. In the plot experiments it has also been high yielding, exceeding the uniform varieties. It is bearded with good straw, does not shatter and is resistant to the rusts and smuts.

During the last 3 years 24 comparable milling and baking tests show it exceeds Thatcher in test weight, flour yield, crumb color, and grain texture. It is outstanding in crumb color ranking highest among 16 wheats. It also has the lowest flour ash of the 16 varieties compared. It averages lower than Thatcher for the other properties and ranks 9th among 16 wheats for an average of 7 principal properties. The correlation coefficient ( $r=.9534$ ) for flour protein-loaf volume was high and the slope of the regression line ( $b_1$ ) equals 46.8 is intermediate.

N. No. 1750

N. No. 1750 is Pilot x Mida (C.I. 12316). It is the 3rd highest yielding wheat in the Uniform Regional Nurseries for the last 3 years. It was advanced to plot experiments at a number of stations because of good yields, strong straw and unusually heavy test weight of grain. It also has good resistance to the rusts and smuts and is one of the most attractive wheats in both the field and bin. In 3 years comparable tests of 24 samples with Thatcher, N. No. 1750 exceeds Thatcher in test weight (ranking 1st. of 16 wheats compared), yield of flour, water absorption, and crumb color of bread. It has a much lower flour ash than Thatcher. It averages lower than Thatcher for all the other properties ranking lowest in loaf volume (optimum bake) of the 16 wheats compared. It was outstanding in test weight but only average in flour yield. The dough mixing time is longer than required for Thatcher. It ranks 12th in protein content, but lowest in loaf volume (all methods) of bread of the 16 wheats compared. It ranks 12th in the summary of 7 principal properties. The correlation coefficient flour protein-loaf volume was low ( $r=.8162$ ) and the slope of the line also low ( $b_1$ ) equals 37.9.

Henry

Henry is the highest yielding wheat in the uniform regional nursery for the 3-year period 1942 to 1944 and was increased and distributed by the Wisconsin Agricultural Experiment Station in 1944. It has also been a high-yielding wheat in Wisconsin experiments and has been tested at Minnesota and South Dakota stations with favorable yield results. During 4 years 20 milling and baking tests show that it exceeds Thatcher with respect to test weight, flour yield, and has one of the lowest ash content of the 16 wheats. Although not the highest in test weight, it yields more flour than any of the wheats with which it was compared. The flour is soft and does not have the granular characteristics of hard wheats. It ranks lower than Thatcher in water absorption, loaf volume of bread by the No. 6, average and optimum bakes. It has a somewhat shorter dough mixing time than Thatcher. It ranks lowest in crumb color, protein content, grain texture and the average of 7 properties of the 16 wheats compared. The correlation coefficient ( $r=.9241$ ) between flour protein and loaf volume was high although the 5 samples were all in the low protein range. The slope of the regression line ( $b_1$ ) equals 35.5 was among the lowest.

S.D. 2280

S. D. 2280 is a beardless selection from a Rival x Thatcher cross, developed at the South Dakota Agricultural Experiment Station. It was tested in the Uniform Regional Nursery for the 3 years, 1942 to 1944, and has been in plot experiments at Brookings for a 5-year period. It is a stiff strawed, early strain which has yielded well in South Dakota experiments.

During 4 years 13 milling and baking tests show that S. D. 2280 exceeds Thatcher with respect to test weight per bushel, protein of wheat, yield of flour, water absorption, loaf volume (No. 6 and optimum), crumb color, and grain texture. It ranks lower than Thatcher in flour ash. The dough mixing time is slightly longer than required for Thatcher. It does not respond to increasing amounts of bromate, requiring approximately half the amount needed for Thatcher for optimum results. These few tests show that it has good grain texture ranking highest among 16 wheats. It ranks fourth in protein, flour yield, loaf volume (No. 6 and optimum) and second in the summary of seven principal properties. No correlation coefficients or regression lines were calculated because of the small number of samples tested.

N. No. 1753

N. No. 1753 is Regent x Pilot (C.I. 12317). It has been the highest quality wheat in the Uniform Regional Nursery for the 3-years 1943 to 1945 and has been advanced to plot experiments at several stations. It has yielded about the same as Thatcher, is awnless, and has good straw and resistance to stem and leaf rust, bunt and mildew. It also has an attractive smooth kernel of heavy test weight. In 13 comparable quality tests with Thatcher (for 3 years) N. No. 1753 is equal to or exceeds Thatcher in all properties except flour yield and grain texture and ranks first in No. 6, optimum, and average loaf volume, among 16 wheats discussed. It is equal to Thatcher in flour ash. It handles satisfactory in the mill but the flour yield is low ranking 15th of the 16 wheats compared. Aside from the low flour yield, it is considered one of the most outstanding strains from a quality standpoint. The dough mixing time (only three years results) indicate that it averages slightly less than required for Thatcher. It ranks 4th in the summary of 7 principal properties. The correlation coefficient was one of the lowest ( $r = .6525$ ) and the slope of the line lowest ( $b_1$ ) equals 23.4.

N. No. 1556

N. No. 1556 is an early bearded selection from a Ceres x Hope-Turkey-Florence cross developed at the Dickinson Substation, Dickinson, North Dakota. It was included in the Uniform Regional Nursery for the 3-years 1943 to 1945 where it was the earliest variety in the experiment for 3 consecutive years. It has been in plot experiments at Dickinson for 4 years and at other N. Dak. stations and at some of the more southern stations for shorter periods. Because of its earliness it has yielded best at the more southern stations, particularly in Nebraska.

During the 3 years (1943 to 1945) 13 milling and baking tests show that N. No. 1556 exceeds Thatcher with respect to test weight, protein of wheat, flour yield, water absorption, and crumb color. It is lower than Thatcher with respect to flour, ash, and loaf volumes (No. 6, average and optimum). N. No. 1556 averaged about the same as Thatcher in dough mixing time. It responds well to increasing amounts of bromate requiring for optimum results about three times more bromate than Thatcher. It ranks tenth among 14 varieties for an average of seven principal properties. No correlation coefficient or regression lines were calculated, because of the small number of samples tested.





The bread baking tests on the 1947 samples (same as used on the 1945, and 1946 samples) were made by a rich highly bromated formula.

Details of the methods used in 1947, with the various ingredients shown in table 1.

Table 1.--Baking methods used for samples of the 1947 crop.

Ingredients	Baking Method	
	Commercial-bromate-malted wheat flour	
Flour (grams)	:	100.0
Yeast (grams)	:	2.0
Salt (grams)	:	1.5
Sugar (grams)	:	5.0
Potassium bromate (grams) 1/	:	.0 to .004
Malted wheat flour (grams)	:	.25
Nonfat dry milk solids (grams)	:	4.0
Shortening (grams)	:	3.0
Water absorption (percent)	:	Optimum for each variety
Mixing time (minutes)	:	Optimum for each variety
Fermentation time (minutes)	:	180

1/ 0, 1, 2, 3, and 4 mg.

Fermentation periods:

1st. punch after 105 minutes  
 2d punch after additional 50 minutes  
 Mold after additional 25 minutes  
 Proofing time - 55 minutes  
 Baked 25 minutes at 450° F.

This baking procedure is based on the method of the American Association of Cereal Chemists, with certain modifications deemed necessary for unbleached experimentally milled flour. Because of the size of the mixing bowl, ingredients sufficient for two loaves were mixed at one time. They were mixed sufficient length of time to develop the dough properly in a Hobart-Swans dough-mixer (108 R. P. M.) with 4 pins in the head and 2 pins in the bowl. The absorption of the flour was calculated from the amount of water added for proper consistency at the time the doughs were mixed. The absorption values are indicated in the tables. When mixed, the doughs were divided, then rounded in the hands, and placed in fermentation granite-ware "catnet" bowls, measuring 6 inches top diameter, 3 inches bottom diameter, and 2-1/2 inches deep. The punches were made by folding the dough approximately 10 times in the hands. At the end of the fermentation period the dough was molded by a Thompson mechanical roll type "A" moulder with rolls set at a clearance of 3/8 of an inch and the compression plate 1-1/8 inches. The molded doughs were placed in baking pans constructed from 2XX tin known as the tall form. The proofing time of 55 minutes, at 86° F. and baking time of 25 minutes at 450° F. were the same for all samples. Two loaves of each sample were baked, but since the ingredients were mixed as for one loaf, t



two are not duplicates in the sense in which that term is usually used and are not so considered herein. Data given in the tables are averages of the two loaves.

The baking trials were made by varying the amounts of bromate (0 to 4 mg per 100 grams of flour) with the formula given in table 1. With this baking procedure the optimum or maximum loaf volume is apparently obtained with the flour from each variety or strain. It has generally been found that the loaf having the optimum volume also has the best crumb color and grain-texture of the different baking tests made. This test appears to bring out the full strength of the wheats somewhat better than the methods previously used. In actual practice a baking test with 1 milligram and another with 2 milligrams of bromate is made on the same day. Bakes with no bromate or increased amounts of bromate (3 milligrams or higher) are made on the following days until the optimum loaf volume has been determined for each variety or strain. Average volumes are calculated from the three best bakes, only. This baking procedure brings each of the samples to its optimum volume by making provision for adequate gas production, by the employment of sufficient sugar and diastatic supplements, and sufficient oxidation by the use of increasing amounts of potassium bromate.

A check or standard flour for control purposes was included in the baking trials with each day's tests. The loaf volume for each of the 51 bakes with the standard flour (12.3 percent protein) and the dates on which they were made are shown in the following tabulation:

Date	Volume	:	Date	Volume	:	Date	Volume	
	cc.	:		cc.	:		cc.	
Nov. 17	718	:	Feb. 10	764	:	Mar. 24	778	
18	732	:	11	775	:	25	778	
19	750	:	12	789	:	Apr. 1	806	
Jan. 5	764	:	16	784	:	5	789	
6	755	:	17	709	:	6	783	
7	767	:	18	754	:	7	786	
12	738	:	19	720	:	12	789	
13	735	:	24	769	:	13	755	
14	738	:	25	772	:	14	766	
15	744	:	26	787	:	19	775	
19	758	:	Mar. 1	772	:	26	755	
26	781	:	2	755	:	27	758	
27	758	:	3	749	:	28	766	
28	760	:	4	758	:	29	761	
Feb. 4	755	:	8	752	:	May 4	786	
5	755	:	22	778	:	6	772	
9	775	:	23	769	:	10	772	
							Average	763
							Standard error	19.7

Fifty-one baking tests were made with the standard flour. The average loaf volume was 763 cc. and the standard error 19.7 cc.